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THE CONDOR

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CONTENTS

PAGE

Yellow-breasted Chat, painting by Andrew Jackson Grayson ..... opposite 265

A Field Study of Some Grouping and Dominance Relations in Ring-necked Pheasants ..... *Nicholas E. Collias* and *Richard D. Taber* 265

Territorial Behavior and Age Composition in a Population of Mockingbirds at a Feeding Station ..... *Josephine R. Michener* 276

Mortality Records as Indices of Migration in the Mallard ..... *Joseph J. Hickey* 284

FROM FIELD AND STUDY

The Brown Booby, a photograph ..... *Ed Harrison* and *Frances Roberts* 298

Post-mortem Color Change in Bird Specimens ..... *Ira N. Gabrielson* and *Frederick C. Lincoln* 298

Migrants and Introduced Species in the Palau Archipelago ..... *S. Dillon Ripley* 299

The Tyrannid *Aechmolophus mexicanus* in Guerrero ..... *Frank A. Pitelka* 300

A New Bird for Idaho ..... *Malcolm Jollie* 300

Nomenclature of the Hooded Jay: a Correction ..... *Frank A. Pitelka* 300

The Chinese Spotted Dove at Bakersfield, California ..... *Ronald T. Reuther* 300

An Ancient Murrelet Goes Inland ..... *Stanley G. Jewett* 301

Body Temperature and Breathing Rate in a Nighthawk ..... *Pierce Brodkorb* 301

Cock Roosts of Nighthawks ..... *Robert K. Selander* and *Sherman J. Preece, Jr.* 302

A Fatal Meal for a Young Robin ..... *Stanley G. Jewett* 303

NOTES AND NEWS 304

COOPER CLUB MEETINGS 304

INDEX TO VOLUME 53 305

YELLOW-BREASTED CHAT

ICTERIA VIRENS

One-half natural size

Painting by Andrew Jackson Grayson

THE CONDOR

VOLUME 53 NOVEMBER-DECEMBER, 1951 NUMBER 6

A FIELD STUDY OF SOME GROUPING AND DOMINANCE RELATIONS IN RING-NECKED PHEASANTS

By NICHOLAS E. COLLIAS and RICHARD D. TABER

The purpose of this report is to describe some aspects of social organization in a wild population of birds. Part of the evidence for the population under consideration, with special reference to the breeding season, has already been reported (Taber, 1949*a*). The current report places more emphasis on social organization during the late winter and early spring. More specifically, we have attempted to answer two main questions for a population of wild Ring-necked Pheasants, *Phasianus colchicus*: (1) Are social groups formed consistently of the same individuals? (2) Do wild pheasants have a dominance hierarchy and, if so, what is the value of and the basis for high social rank? A preliminary abstract of our results has been published (Collias and Taber, 1948).

In large part these problems stem from previous laboratory studies on the domestic fowl, which, like the Ring-necked Pheasant, is a member of the pheasant family (Phasianidae). Fischel (1927), who studied the grouping relations of 500 white leghorns in a large chicken yard, observed that small subgroups were readily formed and that the individual membership of these groups was constantly shifting. Schjelderup-Ebbe (1922) has given detailed evidence for the existence of a dominance hierarchy in domestic fowl, and his work has been confirmed by Masure and Allee (1934). The value of and basis for high social rank in the dominance hierarchy have been summarized by Collias (1943, 1944). The results of all these studies were taken by us as working hypotheses to be tested in our study of wild Ring-necked Pheasants.

PLACE AND METHODS OF STUDY

The study was carried out about five miles from Madison, Wisconsin, in one part of a 349-acre marsh lying along Nine Springs Creek in the town of Fitchburg, Dane County, and in the surrounding uplands which consist of farm country. This marsh, the Nevin Fish Hatchery Refuge, is owned and operated by the Wisconsin Conservation Department. The marsh is frozen in winter and the principal roosting cover is formed by stands of *Phragmites communis* on slightly elevated areas and *Carex stricta* elsewhere. These plants form dense stands within which the pheasants readily find hiding places from enemies and shelter from the weather.

During the period of study the winter population of pheasants on the Fish Hatchery Refuge, as counted by a drive census on January 24, 1948, was at a high level, compared with the seven preceding years as counted by the same method on the same area. The population counts from the winter of 1940–41 to the winter of 1947–48, inclusive, were: 224, 216, 263, 260, 364, 151, 162, and 312. We are indebted to Dr. Robert A. McCabe of the Department of Wildlife Management, University of Wisconsin, for these data and for a critical reading of the manuscript.

Thirty-eight of the 81 cocks and 170 of the 231 hens counted in the marsh during the drive census of 1948 were trapped and individually color marked. Each bird at the time of trapping was weighed, aged by means of the bursa technique (Gower, 1939), and banded with an aluminum band and with a distinctive combination of colored bands. The trapping and banding of the birds was supported by Pittman-Robertson Project 9–R of the Wisconsin Conservation Department. Since colored leg-bands are often not

readily identifiable in dense vegetation or at a distance, each bird was also marked with a rubber film tag pinned through the skin at the back of its neck. These tags carried a colored number fastened to a background of a different color; this method made it possible to identify many individuals readily from a distance. Taber (1949*b*) has described the details of this method.

This population, like other pheasant populations, is subject to rapid turnover. Thus, in the subsequent season's banding operations, there were recovered only one cock and 11 hens of the total banded during the winter of 1947–48. We wish to acknowledge the courtesy of the Wisconsin Conservation Department in providing these data on retrapping in the winter of 1948–49.

Our studies of the grouping and dominance relations of individuals, as reported here, were made mainly during the period February 2 to April 25, 1948. A pile of corn was placed at each of the three main observation posts, and the birds came to feed on this bait. Bait was also used at various trapping stations which extended throughout the marsh. The observation stations were placed at spots known to be most favorable for concentration of the birds. One of these observation stations (I) was well within the marsh, another (II) was on the edge of the marsh where it adjoined a field, and the third (III) was in the marsh next to a creek. The observer was stationed in a blind 15 to 75 feet from the bait. One blind was in a tree (at station I), another on a 20-foot tower (at station II), and the third (at station III) was on the ground. Most of the observations were made at station III. The birds were watched with 9-power binoculars or with a 20-power telescope loaned by the Wisconsin Conservation Department. The observer stationed himself in the blind before dawn and then remained in the blind from two to four hours. Because of the dense vegetation only birds in the immediate vicinity of the bait could be seen from the blind.

The birds generally visited the observation stations in small groups. Each individual which carried a marker or bands was then identified. In some cases it was possible to identify unmarked individuals by various plumage peculiarities. A record was kept of the exact time when a bird arrived at the observation station and also of the time of its departure. The small feeding flocks were somewhat loose and, although the birds of a given flock often arrived at the same instant, sometimes the individuals straggled in over a period of several minutes. It was decided to call members of the same flock all those birds that arrived within a five-minute period of each other or of intermediate flockmates. This arbitrary period seemed sufficiently long to be truly inclusive of individuals moving as one coherent group and sufficiently short to exclude in most cases overlap with subsequent groups.

Additional information on more general grouping behavior of the birds was obtained from trapping records and from observations made during the course of trapping and at other times.

Dominance relations were studied by noting and recording each definite instance of aggressive-submissive interaction between two given birds. The form and significance of such interactions varied according to the sexes of the birds involved and the season during which the interaction took place. Since these observations were begun near the end of the period of sexual quiescence and extended well into the breeding season, the interactions were not all of the simple type leading to precedence in feeding. No clear-cut line could be drawn between the pattern of dominance hierarchies in late January and that of defended territories in April. As the breeding season advanced there was a gradual increase in antagonism between individuals of one sex and attraction between individuals of opposite sexes, the former being more noticeable in males. The occurrence of antagonisms and attractions are presented graphically in figure 1.

Here it may be seen that as testis weight increased, cocks stopped pecking hens and instead began to court them; groups of males were reduced because of mounting antagonism until dominant-submissive pairs were seen, and then these give way to true territory establishment; antagonism between females manifested in fighting or display was seen only as the season advanced to the point where harems began to be established,

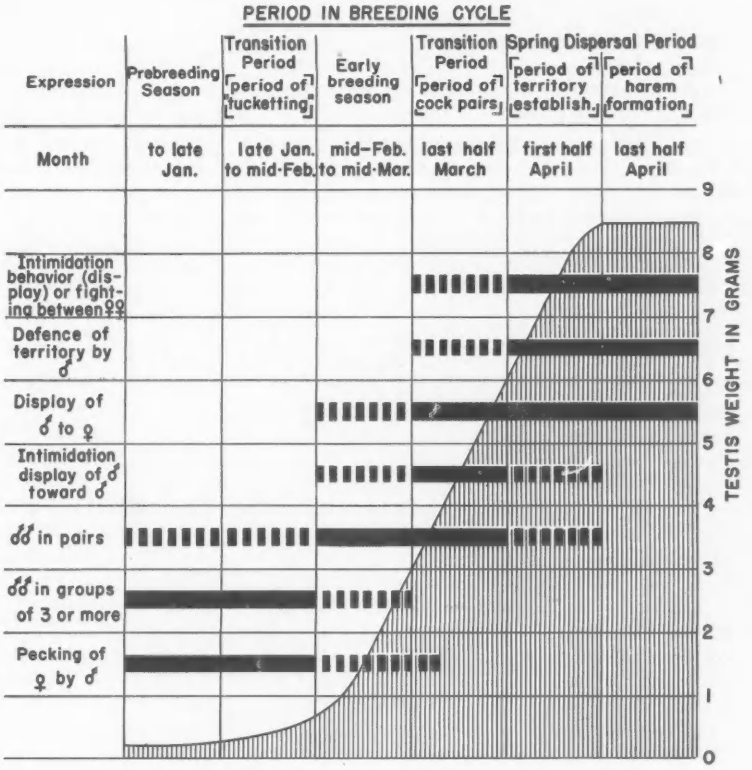


Fig. 1. Expressions of display or dominance between and within sexes of Ring-necked Pheasants near Madison, Wisconsin, from January through April (derived from Taber, 1949). Broken lines represent infrequent occurrence; solid lines, frequent occurrence. The sequence of behavior changes is superimposed upon the increase in testis size.

whereas earlier aggressive-submissive interactions between hens had consisted only in pecking, threatening or chasing. It is possible that this late appearance of fighting or display among hens is based on the dispersal of hens preceding harem formation; this dispersal results in the appearance of "new" hens in the harem, so that these obvious manifestations of antagonism may indicate first encounters between individuals and the placing of the new arrival in the hierarchy of the harem.

GROUPING RELATIONS OF INDIVIDUALS

Three degrees of inclusiveness in grouping patterns among the wintering pheasants in the area of study could be recognized: (1) the entire population of the study area was to a large extent a discrete unit fairly distinct from other local populations; (2) the different sections of the marsh or marsh edge were characterized by certain "local residents" repeatedly recorded in those particular sections; and (3) within each section were small flocks of shifting composition.

From a broad viewpoint the entire pheasant population of the Madison Fish Hatchery Wildlife Refuge can be considered as a unit and one might inquire into the extent of interchange with other local populations. We did not directly investigate this problem.

McCabe (1950) has investigated this problem with reference to the University of Wisconsin Arboretum which lies 1.8 miles to the north of the Fish Hatchery Refuge. This arboretum contains some 600 acres of pheasant cover. The Fish Hatchery Refuge is the first good winter range lying south of the Arboretum. The Arboretum is hemmed in on its other boundaries by large lakes and by the city of Madison. Nevertheless, of 1115 pheasants trapped and banded at the Arboretum and of 1732 trapped and banded at the Fish Hatchery Refuge, during seven winters only one pheasant trapped at one area was recovered in the other. The Fish Hatchery Refuge is surrounded by farm uplands which form something of a barrier to the free interchange of wintering individuals with other local populations. However, there is a possibility of some ingress or egress along the marsh bordering Nine Springs Creek which drains the Fish Hatchery marsh. But on the whole, the winter pheasant population of the study area seemed to be a well-defined and relatively isolated population.

Subdivision of the marsh population into overlapping and local subpopulations was indicated by repeated observation, either on the basis of sight or trapping records or both, of certain individuals at the same bait stations or trapping stations. Neighboring stations were placed between 50 and 100 yards apart. Some degree of interchange was indicated by the trapping of the same individuals at different traps, sometimes widely separated traps, within the marsh. However, there was a tendency toward localization. At station III, for example, the birds seen could be arbitrarily divided into "local residents" and "visitors." Out of approximately 55 individually marked hens observed from the blind at this station, during 50 observation days, only 14 (residents) were seen on nine or more different days, whereas 40 hens (visitors) were seen six or fewer times each (22 hens only once each). Each of the other three was seen eight times. The cocks show a somewhat similar pattern, but with possibly a higher proportion of "local residents." Thus, out of 16 individually identified cocks, 8 were seen six or more times each, whereas 7 were seen only one to three times apiece. The remaining cock was seen four times.

Temporary winter flocks in which individuals moved about and fed together as a more or less coherent unit were found to comprise a shifting membership. Males and females often fed together, but also were often apart during the winter as separate unisexual groups. In these unisexual groups the same individual birds might feed and move and rest together for several hours; but frequently membership of these unisexual flocks shifted from hour to hour. These feeding groups usually consisted of two to 25 individuals. Large flocks seen feeding in an open field might scatter out over a distance of 75 yards and within the larger flocks could be seen loose subgroups composed usually of 6 to 9 birds. Birds were seen at times to move from one such subgroup to another.

More precise observations of the individual composition of winter feeding flocks were made at station III. An example of a typical morning's observation, showing how the birds came and went, is given for the pheasant hens seen on the morning of April 1,

1948. Each individual is represented by a letter. Birds that paid more than one visit are shown in italics.

Time of arrival	Birds seen	Departed by
5:30 a.m.	A B	5:32 a.m.
5:45–5:53	C D E F G H I J K L *M*	6:12
6:06	*N*	6:12
6:20–6:23	*N* *O* *P*	6:35
6:37–6:40	Q *R* *S* *M*	6:44
6:47	T *R* *S* *P*	6:55

The observations on this and other mornings indicated that successive groups arriving at the corn pile tended to be made up largely of different individuals, but that the same individuals in some cases might show up again with different companions in later groups. Occasionally birds came alone and left in the same solitary fashion.

In order to find out whether or not there was any consistent tendency of individual hens to associate with some individuals much more than with others, tabulation was made of the numbers of times that each "resident" hen came to the corn pile within five minutes (*i.e.*, within the same "flock") of the arrival of every other "resident" hen. Table 1 indicates that any such tendency, if it exists at all, must be very slight.

Table 1

Frequency of Specific Association between Individual Pheasant Hens at Station III*

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	Came alone	Number of visits
A		2	3	1	2	4	2	3	5	1	3	4	2	1	0	15
B	2		1	1	2	1	2	4	2	3	1	3	1	1	0	12
C	3	1		2	2	2	4	0	3	3	3	4	2	3	1	16
D	1	1	2		2	2	3	2	1	0	3	0	1	0	0	12
E	2	2	2	2		2	3	2	2	2	3	3	2	1	2	10
F	4	1	2	2	2		5	5	8	2	3	5	2	1	0	12
G	2	2	4	3	3	5		2	6	5	2	4	4	2	2	27
H	3	4	0	2	2	5	2		5	1	3	3	2	2	1	16
I	5	2	3	1	2	8	6	5		4	3	5	3	4	1	21
J	1	3	3	0	2	2	5	1	4		2	3	3	1	2	14
K	3	1	3	3	3	3	2	3	3	2		2	1	3	0	13
L	4	3	4	0	3	5	4	3	5	3	2		2	4	2	18
M	2	1	2	1	2	2	4	2	3	3	1	2		0	0	9
N	1	1	3	0	1	1	2	2	4	1	3	4	0		1	12

*Tabulated are the number of times each resident hen came to the corn pile in company with each other resident hen. Period of observations, February 2 to April 25, 1948.

Only 12 times did resident hens come alone, and only 28 times with "non-resident" hens, but when they came with other residents the specific flock companions varied greatly. Thus Female G came to the food pile 27 times, but with the same companion at most only six times, and she came with every other resident hen at least twice.

Twenty-one flocks of males came to the corn pile at station III. All but four of these flocks consisted of only two or three birds, and these small groups were composed of different combinations of individuals in all but two cases. The gregariousness of winter cocks is indicated by the fact that until well after the onset of the breeding season they were much more likely to come in company with other cocks than they were to come alone. With the onset of the breeding season the average size of male flocks gradually decreased (see figure 1).

Roosting groups of pheasants varied from two to two dozen birds or more. When the weather was very cold, the roosting groups were larger and at least some of the birds of each group roosted closer together. The location of roosts varied somewhat although there were favorite roosting spots.

DOMINANCE RELATIONS OF INDIVIDUALS

Evidence for the existence of a dominance hierarchy among wild Ring-necked Pheasants in winter.—Table 2 illustrates a dominance hierarchy observed on March 16, 1948, in a group of three cocks at a pile of corn at station I. These birds came and went as a definite flock several times. This table refers only to aggressive-submissive interactions over food. All of the three possible relations between any two of the birds, *A*, *B*, and *C*, were observed. The dominance relations were consistent and no cases were observed of a bird subordinate to an individual which it had previously dominated.

Table 2

Number of Aggressive-submissive Interactions among Cocks at Station I Observed on March 16, 1948

Dominant birds	Subordinate birds		
	A	B	C
A	....	7	5
B	....	....	3
C	....	....	....

Table 3

Number of Aggressive-submissive Interactions among Cocks at Station II, February to April, 1948

Dominant birds	Subordinate birds								
	D	E	F	G	H	I	J	K	L
D	....	....	....	....	....	5	2	4	2
E	....	....	....	....	....	2	1	....	....
F	....	....	....	1	1	....	....	....	....
G	....	....	....	....	1	1	1	....	....
H	....	....	....	....	....	....	3	2	....
I	....	....	....	....	....	....	1	....	....
J	....	....	....	....	....	....	....	3	....
K	....	....	....	....	....	....	....	....	....
L	....	....	....	....	....	....	....	....	....

The problem of the significance of these relations is the same as the problem of the chances of always obtaining successive heads or tails in a series of tosses of coins. If the process were a random one, aggressive-submissive encounters between birds subsequent to the first encounter, like the case of coin tossing, would lead to the same results as the first encounter 50 per cent of the time. The number of encounters with the same outcome as the first encounter is $\Sigma(n-1)=15$. There are no cases in the opposite category. The probability of this happening by chance is $(\frac{1}{2})^{15}$, an exceedingly remote contingency. The application of this statistical method to our problem was suggested to us by Dr. James Crow of the Department of Zoology, University of Wisconsin.

Table 3 shows similar evidence for the existence of a dominance hierarchy in a group of nine cocks observed from station II. The aggressive-submissive interactions in this table refer to pursuits and avoidances, including in some cases avoidance of a display-

ing male. Many of these interactions may have had significance with respect to the onset of territoriality rather than with respect to food, since many of them took place away from the immediate vicinity of the bait. Again there was no case observed of reversal of dominance relations in subsequent encounters between the same individuals. This

Table 4

Number of Aggressive-submissive Interactions among Cocks at Station III, February 2 to April 15, 1948

Dominant birds	Subordinate birds							
	H	M	N	O	P	Q	R	S
H	....	1	....	1	....	....	....	....
M	....	....	7	....	2	....	....	....
N	....	....	....	1	3	1	6	2
O	2*	....	1*	....	6	6	....	3
P	....	....	....	....	....	....	1	2
Q	....	....	....	....	....	....	3	....
R	....	....	....	....	....	....	....	....
S	....	....	....	....	....	....	....	....

*Territorial cases of apparent dominance reversal. See text.

Table 5

Number of Aggressive-submissive Interactions among Hens at Station III, February 2 to April 25, 1948

Dominant birds	Subordinate birds													
	A	B	C	D	E	F	G	H	I	J	K	L	M	N
A	....	1	....	....	....	1	....	2	....	....	....	5	1	1
B	....	....	3	....	....	....	....	6	....	....	....	1	....	2
C	1	....	....	....	3	....	1	....	9	....	....	10	2	....
D	....	....	....	....	3	....	....	2	3	....	2	....	2	....
E	....	....	....	....	....	1	1	....	1	1	2	1	....	....
F	....	....	....	....	....	....	7	3	1	1	....	5	....	....
G	....	....	....	....	....	....	....	5	1	3	....	5	1	2
H	....	....	....	....	4	....	....	....	....	....	....	....	2	....
I	....	....	....	....	....	....	....	....	....	....	....	6	4	1
J	....	....	....	....	....	....	....	....	....	....	1	2	1	....
K	....	....	....	....	....	....	....	....	....	....	....	7	1	....
L	....	....	....	....	....	....	....	1	....	....	....	....	....	1
M	....	3	....	....	....	....	....	....	....	....	....	....	....	....
N	....	....	....	....	....	....	....	....	....	....	....	....	....	....

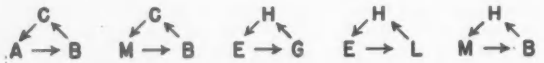
indicates the existence of a dominance hierarchy, although only 11 of the 36 possible paired relationships as calculated by the formula $n(n-1)/2$ were observed.

Table 4 presents evidence for the existence of a dominance hierarchy at station III in a group of eight cocks. The aggressive-submissive interactions referred to in this table were mostly encounters over food, although territorialism may have been involved in a few instances. Seven of the cocks, including cocks M, N, O, P, Q, R and S, are individuals not mentioned above, but one of them, cock H, was also involved in the dominance hierarchy described for the previous observation post (table 3). Only 13 of the 23 possible paired dominance relations of these eight cocks were observed, but all of these were consistent, with the exception of two cases of reversed dominance. These exceptions both involved male O which became territorial and thereupon gained dominance, at least while on his territory, over male H and male N. Actually, the two instances in

which male O dominated male H merely represent successes of O in border conflicts since H had established his territory immediately adjacent to that of O and the observation station was on the border between the two territories. Male N continued to be non-territorial during the period of observations. The evidence for a dominance hierarchy in this group of eight cocks is conclusive, since of 33 aggressive-submissive encounters observed subsequent to the first observed encounter, there was none with an outcome which differed from the first encounter, with the exception of the three territorial instances just described.

A dominance order was found to exist also among pheasant hens, as shown by table 5 for 14 marked hens observed at station III. One bird would peck or threaten to peck another at the food pile, and the threatened bird would thereupon retreat. These hens were the ones most frequently seen at this station, each having been recorded nine or more times. Fifty of the 91 possible paired relationships of these 14 hens were observed. Of 85 instances where an aggressive-submissive encounter involving the same two hens was observed more than once, not one instance was different from the first observed encounter. The probability of chance occurrence of these results is $(\frac{1}{2})^{85}$ or 10^{-60}. It is established, therefore, that these pheasant hens were organized on the basis of a dominance hierarchy during the season of study.

At least five triangles of dominance-submissive relationships existed among these 14 hens, as follows:



All cocks dominated all hens but stopped pecking them soon after the onset of the breeding season (see figure 1).

While the expression of dominance-submission relations within the flock was facilitated by the competitive interaction over food involved at the bait station, such relations were not confined to the bait stations nor to their immediate vicinity. It was sometimes observed out in the open field that when one member of a flock happened to scratch up an ear of corn with a few kernels remaining upon it, another apparently more dominant member of the flock would come, drive off the first bird, and appropriate the find for itself. Such encounters were observed too infrequently, from too great a distance, and too often with unmarked birds to make feasible a systematic study of them.

Interrelations of territorialism and rank in the dominance order.—At each of the three observation stations the cocks that remained to establish territory at or near the food pile were at or near the top of the dominance hierarchy of their winter flocks. At station I the male highest in the dominance hierarchy was the only male seen at this station after March 16, and this male had begun to crow repeatedly and regularly by March 18. At station II the four highest males in the dominance order were the only ones known to crow, and they established territories that adjoined upon this field. At station III, two of the four males highest in the dominance order among eight cocks were the only birds known to crow and establish territories; these territories adjoined the observation station. Of the remaining two males with high dominance, one disappeared (male M), and the other was seen to be beaten in a bluffing contest with one of the territorial males. The beaten bird (male N) possibly became non-territorial since, while it was seen at the corn pile a number of times thereafter, it generally came alone and was never seen to crow.

Summary of all our data indicates a strong association between the establishment of crowing territories and ability to dominate other cocks. Thus, seven territorial cocks

were seen to dominate 22 cocks but were dominated by only four cocks. In contrast, 14 non-territorial males dominated 14 males and were dominated by 34.

The association between high rank in the winter cock hierarchy and ability to establish a territory during the breeding season is suggestive of the true nature of the basis of breeding success. If the winter hierarchy had one basis and the breeding season hierarchy another, one would expect frequent reversals during the transition period as testis growth in some low-dominance cocks commenced earlier than in some high-dominance cocks. Since such reversals were practically absent it would seem either that all high-dominance cocks came into breeding condition before all low-dominance cocks or that high-ranking cocks continued to dominate low-ranking regardless of variation among cocks in testis growth, their submissive status causing the low cocks to become, to some extent, psychological castrates (Guhl, Collias and Allee, 1945). Of these two possibilities the second seems by far the more likely, especially since it may be noted that the eventual fate of many low-dominance cocks probably is to be non-territorial, a state in which low-dominance has caused a suppression of the ornaments and behavior typical of the breeding male.

This general pattern, however, is not invariably followed. It is quite possible that a bird of low-dominance which comes into breeding condition exceptionally early may rise in the hierarchy. Male hormone is well established as a stimulus to aggressive behavior. It has been shown that testosterone stimulates crowing and growth of the wattles in a pheasant capon (Collias, 1950). Allee, Collias and Lutherman (1939) have shown that in domestic hens, male hormone stimulates rise in the dominance order. A single reversal which was apparently based on early functioning of the testes was observed in the course of the present study. Two other cases were observed in which a cock of lower position in the winter hierarchy established a territory adjacent to the territory of a cock which had held a higher winter position. The former successfully defended his territory against the latter in each case; these, however, were by no means true reversals. It is obvious that where a large number of cocks establish territories, not all of the territorial cocks could have been of highest position in the winter hierarchy. Since the defense of territory seems to be invariably successful it is apparent that a territorial cock within his territory is imbued with a valor which quite transcends the arrangements of the previous winter.

During the winter there was a tendency for local residents to dominate "visitors," that is, birds of more casual occurrence, as seen at station III. Seven resident cocks dominated nine visitors and were dominated by only two visitors. A similar but less pronounced trend existed in females. Thus, 15 resident hens dominated 28 visitors and were dominated by 22 visitors.

Value of high rank in the dominance order.—The value of high rank in leading to breeding success in cocks has been pointed out. In winter flocks of cocks and among hens throughout the period of observation, high-dominance rank obviously was associated with precedence to food; and much of the aggressive competition observed centered over food, as described above. Such food precedence probably finds its greatest value at critical periods of food shortage. The birds lost weight steadily during the winter, and the period of study probably represented a relatively unfavorable season with respect to food. Of a total of some 450 aggressive-submissive interactions noted among all hens seen at station III during 50 observation-days, 45 per cent or almost half of these encounters were recorded on three mornings (February 19, March 20 and April 1) when the marsh and adjoining fields had been flooded by rains or pronounced thaws, forcing the birds to rely heavily on the bait stations for food. It should also be noted that the frequency of the aggressive interactions on these mornings was such that

we estimated only one-fourth to one-half of the total number of the interactions which actually took place were recorded.

Survival to the following winter was very restricted, as seems to be usual among pheasant populations. Of 96 hens (15 adult) and ten cocks (two adult) that were trapped in the winter of 1948–49 (Kozlik, 1949) only 11 hens and one cock had been trapped and banded in the winter of 1947–48. We knew the dominance position of only one of these retrapped birds. This bird, hen M, during the time of our study had been near the bottom of the dominance order of hens resident near station III. She was at that time in the first year of life. Her survival to the following winter was not therefore a matter of high dominance nor of age and experience but was either accidental or related to factors unknown to us.

Basis for high rank in the dominance order.—The tendency of local residents to dominate visitors has been mentioned. No definite correlation of weight with dominance was established, although the trend was in a positive direction. All territorial cocks which could be weighed were high in the dominance order and all were relatively heavy birds, but this was also true of some of the non-territorial cocks of lower dominance status. At station III resident hens were weighed from one to nine times each during the period from January 21 to March 13, 1948. The average weight of seven resident hens of high dominance rank was 1000 grams; the average weight of seven resident hens of lower dominance status was 970 grams. The small difference is of doubtful significance.

Age is probably a factor facilitating dominance. At station III, three of the seven most dominant resident hens were two years of age or older, whereas all seven of the hens in the lower half of the dominance order were less than one year old. Data for cocks were insufficient on this point.

The manner in which winter dominance predisposes a cock toward breeding success and the way in which a cock may occasionally reverse positions with a former despot at the start of the breeding season have been presented above.

Some connection is probable between trap shyness and high dominance. Six of the ten most dominant cocks could not be trapped, in contrast to only three of ten low-ranking cocks that could not be trapped in the areas of most intensive study. These individuals, unmarked during the course of our study, were recognized by plumage peculiarities.

THE POPULATION IN SUBSEQUENT YEARS

In the two years following our study, the pheasants counted on the study area fell from 312 birds in the winter of our study (1947–48) to 106 in the winter of 1948–49 (Kozlik, 1949) and 109 in the winter of 1949–50 (Thompson, 1950). We are indebted to the Wisconsin Conservation Department for permission to cite the census data for these last two years. It is evident that our study was made just before a sharp decline in the population. The decrease was first noted during the summer of 1948 in the course of brood observations. So few broods and adult birds were seen that brood observations were discontinued on the area. In the winter of 1949–50 it was found that three groups of pheasants were using the marsh and that there was little or no intermingling among the groups. This situation contrasts with the greater intermingling between birds from different sections of the marsh that we observed in a more dense population.

SUMMARY

During the winter of 1947–48, in a high density population of pheasants in a marsh near Madison, Wisconsin, 38 cocks and 170 hens were trapped, individually color-marked, and released. Many of these birds were observed more or less regularly during late winter and early spring, along with unmarked birds some of which could be distin-

guished as individuals. Unisexual groups of hens or cocks, although often separate, not infrequently mixed together while feeding. The birds were especially gregarious in winter and gradually formed into harems of hens, each harem under a single cock, as the breeding season progressed. Flocks seen at a feeding station showed little if any consistent association between given individuals. Much of the dominance order in these open groups was worked out, and was related to food competition in both hens and cocks. In addition, those cocks which began early to crow and to establish individual territories during the breeding season were generally higher in the dominance order of cocks than those that did not. All cocks dominated all hens, but ceased to peck or drive hens from food soon after the onset of the breeding season. Older birds and trap-shy birds tended to be relatively high in dominance rank; ordinary weight differences within the sexes seemed to be of relatively small importance in deciding social level.

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TERRITORIAL BEHAVIOR AND AGE COMPOSITION IN A POPULATION OF MOCKINGBIRDS AT A FEEDING STATION

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This paper is based on banding records of the Mockingbird (*Mimus polyglottos*) studied at Pasadena, California. It is an attempt to report and explain from banding records and observations the actions and ages of the birds and the assemblages and also the behavior of their various age groups. It is not concerned with individual birds except as they contributed to the understanding of a group. In a sense it is a sequel to a previous paper, "Mockingbirds, Their Territories and Individualities" (Michener and Michener, Condor, 37, 1935:97-140), which should be consulted for a description of the banding station, technique in the use of the color-bands, and conditions existing among the mockingbird population at that time. It seems nearly certain that the behavior patterns described in 1935 are the more usual ones and that the modification described herein resulted from an unusual concentration of food provided at a feeding station.

The banding program described in 1935 continued until 1940 but on a reduced schedule in 1939 and still more so in 1940. The observation of birds wearing color-bands continued until 1946; by then none was left that carried a complete set.

From the beginning of our study, we used raisins very freely to attract mockingbirds. A food tray at each of two east windows in one room was the greatest attraction, and observation convinced us, particularly after 1935, that some part of the mockingbird population within a radius of a quarter of a mile funneled through our yard. The great increase in attendance produced a modification of the conditions in our yard so that we became uneasily aware that the description of mockingbird behavior given in 1935 no longer held.

By 1936 we could state these changes rather definitely. There were many more mockingbirds entering the traps and eating at the food shelves; and, moreover, the territory holders were behaving differently:

1. We saw none of the courting activity of song by the male, the flying to a favorite food shrub, the "hew-hew" of the pairs together.
2. There were no nests in our yard.
3. There was less song around the house, that is, near the feeding places, where formerly the song perches were so favored.
4. While the birds held and defended the winter territories as before, summer defense seemed gone. Sometimes the occupant of the territory containing the food trays did sing a note or two on the roof before dropping down to the raisins to eat, but he ate and left exactly as did the rest.
5. The back part of our lot that had been so strictly divided into territories shared this new acceptance of changed conditions. In March and April, the height of the nesting season, one could find there perhaps a dozen mockingbirds at one time, most of them with color-bands, eating, bathing in the hose spray, or sitting in the bushes.
6. Repeatedly some male seemed to be claiming a territory. He sang low in the shrubs, became more bold, went higher to sing and then he was gone. He did not seem to be driven away. It was as though he had reconsidered.

The color-band combinations were read from the window. The list for the day (not a timed record except at certain times) was filed and later the band numbers were correlated with the color-band record—a check on the reading as well as a necessity for any study of the records. A sheet was made for each bird for each year it appeared, and

every record of it was entered upon its sheet for that year. These sheets and the trapping records supplemented by notes and the records of birds reported to us are the basis of this account.

A young bird which had not yet completed its postjuvenal molt is here termed a juvenile; any bird which had completed such molt, even though it may have been hatched the preceding summer, is called "adult"; thus, birds in first winter plumage are not segregated from older ones.

In our earlier paper there is an account of a pair of mockingbirds which occupied the territory in which the window traps were placed. The beginning of the use of these trays dates from that time. This pair (red-sub-R and yellow-sub-R) brought their young to this food; we watched the young as they were taught to eat there and saw them come there to eat alone later. The *Feijoa* tree nearby was visited by other adults for the food its thick, sweet petals afforded. The territory owner permitted this after a first

Table 1

Number of Mockingbirds Recorded by Sight Compared with Number Trapped

	1936	1937	1938	1939	1940
Juveniles					
Sight records	40	40	24	6	1
Per cent of total banded with sight records	51.9	39.6	21.8	28.6	5.5
Trap records only	37	61	86	15	17
Per cent of total banded with trap records only	48	60.4	78.2	71.4	94.4
Total banded	77	101	110	21	18
Adults					
Sight records	143	224	224	238	73
Per cent of total banded with sight records	264.8	132.5	260.5	626.3	235.5
Trap records only	29	99	53	18	24
Per cent of total banded with trap records only	53.7	58.6	61.6	47.4	77.4
Total banded	54	169	86	38	31

resistance, singing often as they came but not otherwise claiming ownership. When the flowers were gone visitors ceased to come. But adults did bring young to the shrubs nearby to feed them raisins. These juveniles used the shelves; we were amused by their show of begging to be fed. Later they came alone and again amused us by their assumption of the manner of adults claiming a territory. They did not sing but spent much time there *chip*ping constantly. The adults did not do this at this season and we knew the immature birds would be driven out as soon as the adult owner wished to assert his winter claim to the territory.

With this earlier picture in mind, we were surprised to note after 1936 that most of the birds now coming to the food shelves were old birds. This opinion was based on their manners at the food shelves for all were color-banded and the combinations were too many to recognize without reference to the records. Of course, the known territory holders were recognized and young juveniles could be identified readily as such. Table 1 was prepared to see if the facts were as we suspected. This table shows for five years, beginning with 1936, for juveniles and adults, the number of birds recorded at these food shelves, the number with trap records only and the total number banded. It also shows the percentage of the total banded in the two age groups that had sight records and that had trap records only. In looking at it, it should be remembered that the years 1939 and 1940 are not important for the number banded. They represent decreasing activity in the banding program but the observation of the color-banded birds was con-

tinued. The decrease of these in 1940 represents the difficulty of obtaining the raisins for food and in the war years very few were available.

Table 1 shows that there were a great many more adults than juveniles frequenting the shelves and that our feeling that there had been a change in behavior was justified. It shows that, with increasing numbers of juveniles banded, the actual number of them using the food shelves decreased as did the percentage of juveniles banded each year that were seen at these shelves. For the adults, remembering that each bird often made a great many visits in a day, it is clear how their increasing use of this food was enabling them to monopolize the shelves. It will be noted that the total number of adults banded in any year bore no constant relationship to the number of juveniles banded that year but varied greatly. But the percentage of adults banded each year that failed to be seen at the food shelves (trap records only) is surprisingly close to the same figures for juveniles. Therefore, the flood of old birds coming to the food at the shelves represents birds banded in previous years—the old and experienced territory-holders of the vicinity. These were the ones that in earlier years had learned of this unfailing food source. It should be stated that this was not the only place in the yard where raisins were obtainable. They were always in the traps and around the traps so the resulting records could not be explained by competition for food limited to a single source.

Beginning in 1933 all mockingbirds were banded with the full set of colored bands. When in 1936, and subsequently, the lists of color-banded birds at the food shelves were made, it was always possible to determine when each bird was banded. Table 2 was made to shed more light on the ages of these adults that were coming to the shelves. It shows the number of mockingbirds banded as juveniles in 1933, 1934 and 1935 known to be alive in later years by trapping and by sight records. Some birds were known both by trapping and by sight records and every bird trapped as an adult in more than one year, shown in table 2, was also noted in sight records. Some, as adults, were known only by sight subsequent to banding.

Table 2 shows that the older birds used the food-shelves in preference to the traps and also that trapping figures alone give, for these birds, a less acurate measure of survival ages than the color-band method because there are, in almost every case, substantially fewer known to be alive in a certain later year by trapping than the sight records show to be still extant. If the trapping figures for 1934 and 1935 are disregarded, the disparity is still greater. In conjunction with table 1 it seems fair to assume that birds banded as juveniles did not make any extensive use of the food shelves when immature, but that, as they grew older, many held territories near enough to the area in which they were reared to use these food sources for themselves and their young.

In our 1935 paper reference was made to certain juvenal birds which, while still immature, made efforts to hold small territories in our yard. There were also small groups of young birds—two, four, or even as many as ten—seen sitting quietly together in a shrub while one sang the juvenal type of song. These birds stayed with us for some time. For some of them there are many pages of notes. On the other hand there were a great many more juveniles banded for which one single entry appears, or they were present two or three days. The number of sight observations in later years indicates, as shown in table 2, that after summer dispersal they did, in many cases, return to this vicinity near which we assumed they were reared and acquired territories or mated with birds already territory holders. It seemed probable that a juvenile that had endeavored as an immature bird to hold a place of its own might be most apt to be one that would return as an adult. From the sheets of sight records for 1936, nine such birds were found that had records of from 8 to 57 appearances at the food trays. Of these nine juveniles

two stayed around our yard until late August, two until late September and two until driven out, to our knowledge, on October 27. Three were recorded as trying to hold small territories, another as a very persistent singer. Of the nine, six did return in 1937 and were again identified at the food trays. They had territories nearby but not in our yard. With this beginning, although it was apparent from the records shown in table 1 that the juveniles had used the food shelves less and less, more were looked for that might add to this list of young birds known at the food shelves as young or later as adults. Among the records for juveniles at these shelves for the years 1937, 1938 and 1939 only one had more than five entries. That one had thirteen and evidently did obtain

Table 2

Juvenal Mockingbirds Banded in 1933–1935 Known to be Alive in Later Years

By Trapping Record[1]

Year of banding	1934	1935	1936	1937	1938	1939	1940	
1933 136 banded	20	6	6	4	3	1	0	27 retrapped in later years
1934 97 banded		8	13	5	5	0	0	16 retrapped in later years
1935 115 banded			20	11	7	3	1	20 retrapped in later years

By Sight Records

1933 136 banded			11	8	6	8	2	24 in sight records in later years
1934 97 banded			22	9	5	6	1	34 in sight records in later years
1935 115 banded			23	25	9	6	3	43 in sight records in later years

[1] The left hand column gives for each year the number of birds banded; the next seven columns, the number that returned to the traps or that were seen and identified by their colored bands in years subsequent to that of banding. One bird might return more than one year and the ones that returned in any one year would perhaps differ from the ones that returned the preceding or following years. The number in the last column is the actual number of individuals involved in the returns for the banding year in the first column.

a foothold, for it had trap records for that year until December. After 1936, however, one or sometimes two sight records on the sheet of a juvenile is the rule. This change in the use of the food shelves therefore seems dated with some definiteness.

Additional evidence that juveniles that remained the longest in our yard were the ones most apt to return as adults was obtained from the first years of our color-banding program (1933–1936). Such juvenal birds were divided into three groups: (1) recorded by sight records as here less than a week (172 birds of which 17 or 9.8 per cent returned as adults); (2) here less than a month but more than a week (52 birds of which 9 or 17.3 per cent returned as adults); and (3) recorded as here longer than a month or for more than one period during the summer (55 birds of which 28 or 50.9 per cent returned as adults). This seems added evidence of the return of juveniles to the vicinity of their original home and also that the ones that stayed longest here were the ones most apt to return. It should be noted that these records were made in years with extremely favorable nesting conditions as judged by the number of young recorded by us.

Why did most of these young birds relinquish the use of the food trays? The answer to this would seem to be that the behavior of the adults was such that it excluded the

timid, slow and inexperienced. The adults in procession that came to the food alighted in the shrubs nearby or on the roof above it. They went to the food one at a time, ate one to three or four raisins rapidly and, if feeding young, picked up all they could carry and left. The next bird then came to the food. This does not mean that there were never two or even three on a tray at one time, but usually there was only one. The order of precedence was rarely questioned. There was rapid and steady replacement. Occasional slow-ups were due to individual idiosyncrasies. One female, a well-known bird, was always slow. She sat long on a perch above the tray and always long at the tray. She had occupied a territory including the window shelves the preceding winter. Another disturbing bird always ate only apple and took endless time to do it. The bushes filled with waiting birds at these times. Watching indoors, our own tension built up until some aggressive bird would stand no more delay and would dart at the apple eater. She would leave immediately. But the most serious cause of a traffic snarl was the arrival of a young bird at the food. It seemed confused and uncertain. It might simply stand still

Table 3

Number of Mockingbirds Banded from 1925 to 1940

Year	Juveniles	Adults	Total
1925	1	9	10
1926	12	19	31
1927	2	7	9
1928	29	15	44
1929	58	21	79
1930	22	17	39
1931	4	11	15
1932	3	13	16
1933	136	41	177
1934	97	18	115
1935	115	45	160
1936	77	54	131
1937	101	169	270
1938	110	86	196
1939	21	38	59
1940	18	31	49

and not eat, or it might beg from any adult that came to the tray. Soon adults began coming anyway, ignoring it till one more assertive than the others drove it away. The records suggest that once was enough. There was food elsewhere.

To present convincing evidence of the rapidity of replacement in this procession of adults, they were sometimes watched and recorded for a timed period. On May 14, 1939, in a thirty minute period 96 birds were counted. This was a greater number than could be identified, but 57 band combinations were recorded and 14 were put on the "unbanded" tally count. On another day, 80 combinations were listed in a one-hour period. Such a count always showed many repeat visits from individual birds. It seems true that the change to this specialized use of these food shelves was a gradual one that had, by 1937, become quite fixed and accepted by both juveniles and adults.

Table 3 shows the number of juvenal and adult mockingbirds banded by us during the years from 1925 to 1940. This record shows that there were great fluctuations in the numbers of birds banded in different years. This does not represent fluctuating operation of the banding station. The intensive feeding program is certainly reflected in the great increase beginning in 1933. It probably coincided with extremely favorable conditions also. There was a relatively high peak in the number banded in 1929. In almost every

species of birds banded in any conspicuous number these peaks occur. It is also noticable that different years show a great difference in the ratio of juveniles to adults banded. These facts are basic to an understanding of the age groups represented in different years.

Thus, in table 4, the mockingbirds that were identified each year from 1936 to 1940 are broken down into age groups to present a picture of the birds known to be present during each of those years. Although the station operation was reduced in 1939 and more in 1940, the two years are included because the identification of color-banded birds continued. In table 4 it should be noted that the at-least-one-year-old birds consist of all adults banded in any one year. Most of these are banded in the spring or summer but there are, in addition, a few that come in late autumn which could therefore be less than a year of age but which are included to avoid for so few another category of a fractional part of a year.

In table 4 one surprising point is evident: birds two years old practically equaled or outnumbered those one year old in every year but one. This, of course, is not entirely

Table 4

Mockingbirds Identified by Either Trap or Sight Records

Identified birds	1936	1937	1938	1939	1940
Juveniles	77	101	110	21	18
1 Yr. old	24	25	27	23	5
At least 1 Yr. old	54	169	86	38	31
2 Yrs. old	36	34	13	22	13
At least 2 Yrs. old	17	35	98	45	10
3 Yrs. old	14	13	15	13	8
At least 3 Yrs. old	8	17	23	57	13
4 Yrs. old	0	10	9	11	3
At least 4 Yrs. old	12	11	4	15	11
5 Yrs. old	0	0	10	6	3
At least 5 Yrs. old	3	12	8	5	4
6 Yrs. old	1	0	0	13	1
At least 6 Yrs. old	0	3	5	4	3
7 Yrs. old	1	1	0	0	2
At least 7 Yrs. old	1	0	5	5	0

true because the at-least-one group probably consists chiefly of birds one year old. Because a remarkably consistent number of one-year-olds returned each year, the difference in numbers of one- and two-year birds cannot be explained by variation in banding effort. The one-year-olds as a group would probably be the juveniles we had banded early in the previous year, juveniles that were the offspring from nearby territories and that had stayed long in our yard and knew it. Now, as adults, they would, if possible, settle in our immediate neighborhood.

The greater number of two-year-olds may be attributed to a second group of birds, those banded later in the summer that come when juveniles are dispersing, and for these we often have no records in the first year beyond the date of banding. They occur near the feeding station only as local vagrants, and as one-year-olds evidently return to the vicinities of their original homes. Many of these would settle within the one-fourth-mile radius of our station. Later they would learn of the food supply at our trays, but only gradually, and apparently some of them did not learn this in their first year as adults. This seems reasonable and especially so in view of the fact that the distance from which some of these birds were known to come was greater than our closely watched birds ever seemed to go from their home territories. This was not, as has been stated, the behavior of local mockingbirds in the earlier years of our station operation. Thus, whereas nor-

mally the numbers representing different age groups in a stable population would be expected to decrease annually, here the two-year-old class does not do so for the reasons just given. This influx of adults must certainly affect territorial phenomena near the feeding station.

In 1938, however, the two-year-olds were reduced to less than half of the one-year-olds for that year. The total of 169 adults banded in 1937 may offer an explanation. In 1938 the food shelves were crowded, and two-year-olds beginning to use the shelves were to some extent forced back to the traps for food by the numbers of experienced birds at the shelves. This is suggested by the fact that in 1938 more two-year-olds were recorded by trapping than by sight, indicating that a large proportion of them resorted to the traps.

Attention should be called to the effect on the station population, from 1938 to 1940, of the large group of adults banded in 1937. It may be found in the at-least-two group

Table 5

Greatest Known Age Reached by Mockingbirds Banded between 1925 and 1940

Age-groups and totals banded	Greatest known age	Number of individuals	Per cent of total
Juveniles, 806	1 year	90	11.0
	2 years	63	7.8
	3 years	34	4.2
	4 years	29	3.6
	5 years	20	2.5
	6 years	20	2.5
	7 years	6	.7
	8 years	2	.2
	9 years	2	.2
	10 years	2	.2
	11 years	1	.1
	12 years	1	.1
Adults, 594	At least 2 years	129	21.7
	At least 3 years	87	14.6
	At least 4 years	50	8.4
	At least 5 years	32	5.4
	At least 6 years	27	4.5
	At least 7 years	8	1.3
	At least 8 years	2	.3
	At least 9 years	3	.5
	At least 10 years	1	.2

of 1938 and the at-least-three group of 1939 and, in spite of reduced feeding and observation, a rather impressive carry-over as evident for birds at-least-four in 1940.

In table 3 it may be seen that in 1931 and 1932 almost no juveniles were banded. We also knew of the death of three of the seven that were banded. That lean period is observed in the birds listed in table 4. In 1936 the zeros for birds known to be four and five years of age should be expected, also the ones for birds of five and six in 1937, for those of six and seven in 1938 and those for seven in 1939. On the other hand, the large number of juveniles banded in 1933 and for the following years produces a very consistent number of three-year-olds in 1936, 1937, 1938 and 1939 and of four-year-olds in 1937, 1938 and 1939. The 13 six-year-olds of 1939 also recall that banner year for juveniles.

Many small bits of interesting information were found in assembling the records for table 4. For one bird never trapped after 1936, there are sight records until 1941. Another

was not recorded between 1936 and 1942. Several with trap records as juveniles had trap records for the following year, some for the two following years and then only sight records at the food shelves. On the other hand, a few adults were recorded only from trap records and for several years.

In order to make a report on the ages reached by the mockingbirds that have visited our station all records for them have been reviewed. This report (table 5) is made from color-band identifications by us or others, trapping records, and all reports of dead birds. The greatest known age reached by an individual is all it offers. Many lived longer and some were older than the recorded age because in adults the age at banding could be only entered as at-least-one year. There were 806 juveniles banded and 594 adults; but more adults than juveniles appear in our records for this report. The reasons for this have been discussed in examining table 4. Practically all of the records in table 5 for the oldest birds came from the color-band identifications. There would be more of them were the bands more durable. Birds wearing only remnants of their band combinations were observed after 1940 in increasing numbers. If a single band were gone, the bird was placed in an age group which represented the last used combination that could have degenerated into the three bands it wore. It is therefore clear that these ages are all below rather than above the true ages.

SUMMARY

From 1936 to 1940, following establishment of feeding trays as a source of abundant food for a population of color-banded mockingbirds at Pasadena, California, the proportion of adults increased and the proportion of juveniles decreased. The adults consisted of old and experienced territory-holders from areas within one-fourth mile of the feeding stations. Compared with previous years, a persistent and proportionally large traffic of adults moved into and out of the area now holding the feeding stations. No breeding territories were established there, when in former years typical territorial occupation by a number of pairs took place. Older birds used the food shelves in preference to traps, and survival data based on sight records are therefore more extensive than those based on trap records. Juveniles that remained the longest near the feeding station were the ones most apt to return as adults in subsequent years. Of birds banded as juveniles only 11 per cent were recovered after one year. Recovery percentages for birds banded as adults were higher. Mockingbirds may reach an age of at least 12 years.

Pasadena, California, May 15, 1951.

MORTALITY RECORDS AS INDICES OF MIGRATION IN THE MALLARD

By JOSEPH J. HICKEY

This paper has been written as a critical appraisal of the banding technique in revealing autumnal migration routes of waterfowl. It has particular reference to the Mallard (*Anas platyrhynchos*) in North America. That serious technical problems now face ornithologists in summarizing the wealth of migration data available for some species of North American waterfowl must be apparent to everyone who has scanned the excellent report on banding records recently compiled by Aldrich (1949) and his colleagues in the United States Fish and Wildlife Service. It is clear from this report that banding analyses in the future will more and more summarize extensive lists of recoveries on a percentage basis. Without in any way reflecting discredit on the very useful work that has already been reported in this way, I wish to explore the potential biases present in percentages of this kind in the hope that future analyses can be carried out with increase in precision.

This study represents a joint contribution of the United States Fish and Wildlife Service, the John Simon Guggenheim Memorial Foundation, and the University of Wisconsin. During the course of the work, I received much encouragement and assistance from J. W. Aldrich, Clarence Cottam, Lois Horn, F. C. Lincoln, A. L. Nelson, C. S. Robbins, and G. A. Swanson; I also became greatly indebted to A. S. Hawkins, H. A. Hochbaum, R. A. McCabe, L. K. Sowls, and J. Van Tyne for advice and criticism. My wife, Margaret B. Hickey, rendered invaluable assistance by checking banders' reports and by punching some 20,000 IBM cards from which part of the following samples were taken.

To a very considerable extent, the studies of the migration of banded waterfowl have involved analyses of the distribution of mortality reports turned in by literate hunters in Canada and the United States. These are the records that will be examined in the present study. About 87 per cent of the recovery localities cited on Mallard banding cards of the Fish and Wildlife Service in 1946 I found to refer to the place where a duck was shot; the remaining 13 per cent refer to the home locality of the hunter. Because the present study does not, for the most part, break down hunters' reports below the state or provincial level, and because so few hunters buy out-of-state licenses, I feel that the potential error from reports referring to home localities has been here kept to a negligible minimum.

DISTORTIONS PRODUCED BY DIFFERENTIAL VULNERABILITY TO HUNTING

Emlen (1940) and Lack (1943, 1946) have shown that in some species of birds the young in the early part of the fall have a higher mortality rate than do adults. Hochbaum (1944:109, 159-160) has presented evidence that some young waterfowl are similarly more vulnerable to hunting than adults. Although during the past five years this phenomenon has become common knowledge among waterfowl biologists in North America, its statistical verification has awaited a report by Bellrose, Hawkins and Low (in press).

Is the percentage of banded waterfowl reported shot in a given state or province in any way affected by this greater vulnerability of young ducks to the gun? Some instructive data on this problem are set forth in table 1 which summarizes some banding work undertaken mainly by Ducks Unlimited (Canada). In this table birds banded after August 31 represent those banded for the most part during the hunting season and shot

during that same season. While the samples are too small to bring out minute differences, the results take on some meaning when they are considered in the aggregate for the two provinces of Alberta and Saskatchewan. (1) Among birds banded before September 1, 25 per cent of the 272 young were shot in the province in which they were banded, in contrast to 14 per cent of 710 adults. This difference at once leads one to suspect that the recorded percentage of young recovered to the south will tend to be less than that

Table 1

Reported Recoveries of Canadian-banded Mallards on a Percentage Basis

Where banded	Latitudinal zone where reported shot	Shot as young		Shot as adults	
		Banded before Sept. 1	Banded after Aug. 31	Banded before Sept. 1	Banded after Aug. 31
	(Size of sample)	(175)	(189)	(211)	(129)
Alberta	1. B.C.-Man.	35	29	25	29
	2. Wash.-Mich.	21	25	24	22
	3. Ore.-Ill.	23	25	27	26
	4. Calif.-Mo.	10	10	10	14
	5. Ariz.-Tenn.	5	5	4	5
	6. Tex.-Miss.	5	6	10	5
	(Size of sample)	(97)	(107)	(499)	(187)
Sask.	1. Alta.-Ont.	27	36	17	20
	2. Id.-Mich.	13	6	16	7
	3. Ore.-Ohio	21	24	23	23
	4. Calif.-Va.	9	7	10	12
	5. Ariz.-S.C.	14	14	15	18
	6. Tex.-Fla.	16	14	19	21

recorded for the adults. For latitudinal zones 4 to 6 in table 1, these statistics are 27 per cent for young birds against 37 per cent for the adults. (2) If recoveries are considered regardless of banding date, we find that 24 per cent of 568 young were reported shot in their "home" province in contrast to 16 per cent for 1026 adults. Resulting recoveries in the three more southern zones run 26 per cent for young birds and 38 per cent for adults.

Does this mean that fewer young birds than adults are shot in the South? We can approach this question separately by plotting young and adult records geographically on a percentage basis. From figure 1, in which only birds banded in Canada are considered, it would appear that relatively more immature birds than adults are shot in September and October in Canada, that during the same period relatively more adults are shot in the northern states, and that a smaller percentage of the young birds seems to be shot in the South. The two sets of percentages should imply the rate at which these two age groups are shot on their wintering grounds near the end of the season under a condition involving equal numbers of adults and of young at the start of the hunting season. (This condition is the result of our permitting 100 per cent to represent the total number of birds in each age group in the above analysis.) The possibility that young birds are markedly more wary than adults, and are less apt to be shot, near the end of the hunting season, has been thoroughly ruled out by Bellrose, Hawkins and Low (*ibid.*). We must therefore conclude that this difference between the age groups in late hunting season kill data in the South is an aberration resulting from (a) the differential vulnerability of the two age groups in the early part of the hunting season and from the percentage method of summarization or (b) differential migration by the two age groups. This last possibility surely deserves special study.

A further exploration of relative vulnerabilities to hunting can be made by comparing the monthly distribution of hunting mortality for 2883 adults (banded in Canada and the Northern States) against that of 610 juveniles banded in various parts of the continent before the start of the hunting season. This is carried out in the first half of table 2. Now in December and January, 28.3 per cent of the adults were reported shot against 21.8 per cent of the juveniles, which are now better referred to as first-year birds.

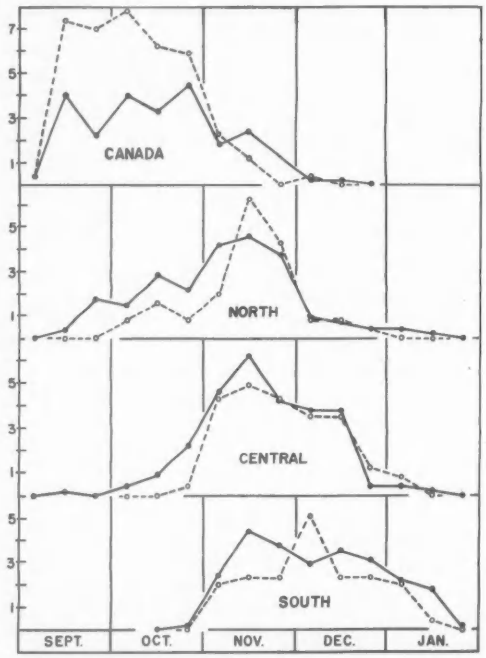

Fig. 1. Frequency polygons showing distribution of hunters' reports of Mallards banded in Canada before September of season in which they were shot; data arranged to show their mortality by ten-day periods. Solid lines represent 453 adults; broken lines 252 immature birds. Ordinate scale represents per cent of birds. "North," "Central," and "South" represent approximately equal latitudinal belts of the United States. Kills for the 31st days of October and December were omitted from total numbers of birds.

It seems a safe assumption to state that during these two months, vulnerability of first-year birds was at least as great as that of the adults. Temporarily ignoring sampling error (the confidence limits in samples like these being about 3 per cent), we can divide 28.3 per cent by 21.8 to get a correction factor of 1.30 which can be used to multiply each value in the monthly frequency distribution of hunting mortality for the immature birds. This correction in the adjusted distribution is shown in the lower part of table 2. Thus, for these particular birds (and not necessarily all Mallards), it would seem possible that

the immature birds may be twice as vulnerable to gunning in September and October as the adults are in the same period. Because the adjusted November value for the immatures rather closely approximates the actual November value for adults, I suspect that the sampling errors restricting the calculation of a correction factor here are of a minimal nature.

As a possible check on this correction factor, the Canadian banding data shown in figure 1 were recast into table 3 along with some North Dakota data to illustrate the

Table 2

Monthly Distribution of Hunting Mortality in Mallards

When reported shot		Sept.	Oct.	Nov.	Dec.	Jan.	Dec.-Jan. subtotal
Age group	No. in sample	Actual distribution by per cent					
Adults	2883	7.3	20.3	44.2	22.5	5.8	28.3
Immatures	610	11.1	33.4	33.6	19.0	2.8	21.8
		Adjusted distribution (see text)					
Adults	2883	7.3	20.3	44.2	22.5	5.8	28.3
Immatures	.....	14.4	43.4	43.7	24.7	3.6	28.3

effect of sampling a population farther south. A purely negative check on vulnerability of first-year birds to gunning is possible if we can assume (1) that immature birds are shot at least as frequently as adult birds in the Southern States and (2) that sampling errors do not seriously mar the regional frequencies here calculated. Thus 24.5 per cent for Canadian-banded adults shot in the South would be divided by 19.8 (for immatures) to give a correction factor of 1.24. When this factor is muitiplied against each value in

Table 3

Geographic Breakdown of Hunting Mortality Encountered by Certain Adult and Immature Birds

Age when shot	Adult		Immature	
Place banded	North Dakota	Canada		
Size of sample	592	453	252	
Where reported shot	Percentage frequencies			Corrected (see text)
Canada	12.8	24.1	39.7	49.2
Northern States	26.4	24.1	17.5	21.6
Central States	32.3	27.4	23.0	28.5
Southern States	28.5	24.5	19.8	24.5
Total (%)	100.0	100.1	100.0	123.8

the actual frequency distribution of the 252 immatures, a corrected series (shown in the last column in table 3) gives the relative vulnerability of the two age groups in the three other regions. Thus in Canada, immature birds would appear to be about twice as vulnerable as adults. The small sample of immatures here considered does not demonstrate any marked changes in the vulnerability of those first-year birds once the birds have left Canada.

The size of the samples here considered surely restricts the conclusions one can draw on this problem, and I hesitate to claim that the approximately same results obtained by the different analytical approaches are anything more than coincidence. Both tech-

Table 4

Hunting-season Reports of Adult Mallards Banded in Western North America

Where banded		Brit. Col.	Montana	Alberta	Sask.	N. D.
Size of sample		1258	254	211	499	592
		Per cent of reports in each sample				
Where reported shot						
Zone 1	Alaska	1.4	.....	.....	.....	.....
	Brit. Columbia	44.6	2.0	0.5	.....	.....
	Washington	43.0	8.7	10.4	.....	.....
	Oregon	5.0	13.0	4.3	.....	0.3
	California	0.6	14.9	1.4	.....	0.2
Zone 2	Yukon-Mackenzie	0.2	.....	.....	.....	.....
	Alberta	3.1	11.4	20.9	2.2	2.4
	Idaho	0.6	28.3	7.1	0.8	0.3
	Nevada	0.1	1.6	0.5	.....	.....
	Utah	.....	1.6	.....	0.2	0.2
	Arizona	.....	.....	.....	.....	.....
Zone 3	Montana	0.4	15.4	8.5	1.6	1.3
	Wyoming	0.2	.....	2.4	0.6	.....
	Colorado	0.1	0.4	5.7	1.8	.....
	New Mexico	.....	.....	0.5	0.2	0.9
Zone 4	Saskatchewan	.....	1.6	1.4	10.6	6.4
	North Dakota	0.1	.....	2.4	7.2	11.4
	South Dakota	.....	.....	3.8	8.4	4.4
	Nebraska	.....	.....	7.1	4.8	4.6
	Kansas	.....	.....	0.9	3.4	3.7
	Oklahoma	0.1	.....	0.9	3.4	2.7
	Texas	0.1	0.8	7.6	9.8	4.7
Zone 5	Manitoba	0.2	.....	1.9	4.2	4.1
	Minnesota	.....	.....	1.9	5.4	5.9
	Iowa	.....	.....	0.9	3.0	6.1
	Missouri	.....	.....	1.9	4.0	4.9
	Arkansas	0.1	.....	1.9	10.6	11.6
	Louisiana	.....	.....	1.9	7.0	6.8
Zone 6	Ontario	0.1	.....	.....	0.2	.....
	Wisconsin	.....	.....	0.9	0.4	2.0
	Illinois	0.1	.....	1.4	6.0	10.9
	Kentucky	.....	.....	.....	.....	0.2
	Tennessee	.....	.....	0.5	0.8	0.9
	Mississippi	.....	.....	0.5	1.4	1.3
Zone 7	Michigan	.....	.....	.....	0.2	0.3
	Indiana	.....	0.4	.....	0.4	.....
	Ohio	.....	.....	.....	0.2	.....
	Alabama	.....	.....	.....	0.4	0.7
	Virginia	.....	.....	.....	0.2	.....
	South Carolina	.....	.....	.....	.....	0.7
	Georgia	.....	.....	.....	0.2	.....
	Florida	.....	.....	.....	0.2	.....

Table 5

Hunting-season Reports of Adult Mallards Banded in Interior North America

Where banded		Man.	Minn.	Wis.	Ill.	Mo.	Ark.	La.
Size of sample		194	112	99	1718	220	277	498
		Per cent of reports in each sample						
Where reported shot								
Zone 1	Alaska	.....	.....	.....	0.06	.....	.....	0.2
	Misc. Canada	.....	.....	.....	0.2	.....	.....	0.4
	Oregon	.....	.....	.....	.....	.....	0.4	.....
Zone 2	Alberta	.....	0.9	.....	0.9	3.6	1.8	3.4
	Idaho	.....	.....	1.0	0.2	.....	.....	.....
	Nevada	.....	.....	.....	0.06	.....	.....	.....
	Utah	.....	.....	.....	.....	.....	0.4	0.2
Zone 3	Saskatchewan	1.5	0.9	1.0	2.2	5.0	5.1	5.2
	Montana	.....	.....	.....	0.1	0.5	0.7	0.2
	Colorado	.....	1.8	.....	.....	.....	0.4	1.5
Zone 4	Manitoba	**17.5**	1.8	4.0	4.7	2.3	6.1	6.0
	North Dakota	8.3	5.4	2.0	3.7	5.5	4.7	4.8
	South Dakota	1.4	1.8	3.0	3.3	4.5	5.1	4.6
	Nebraska	1.0	2.7	.....	0.9	3.6	2.9	2.4
	Kansas	1.0	0.9	.....	0.7	2.7	1.1	2.0
	Oklahoma	1.4	3.6	.....	0.4	4.1	1.4	1.8
	Texas	5.7	4.5	1.0	1.4	8.2	2.2	3.0
Zone 5	Minnesota	15.5	**25.9**	17.2	15.2	8.2	11.6	13.9
	Iowa	5.2	1.8	2.0	4.9	6.8	4.7	5.2
	Missouri	5.7	5.4	.....	2.2	**13.2**	1.8	5.2
	Arkansas	9.3	11.6	3.0	8.6	11.4	**27.1**	9.0
	Louisiana	5.7	6.2	4.0	5.3	8.2	6.5	**13.1**
Zone 6	Ontario	0.5	.....	1.0	0.7	.....	0.7	0.4
	Wisconsin	1.0	3.6	**30.3**	6.9	0.9	1.4	3.4
	Michigan	0.5	.....	3.0	1.7	.....	.....	0.4
	Illinois	9.8	13.4	13.1	**25.0**	7.7	8.3	11.6
	Indiana	.....	.....	2.0	1.9	0.5	0.4	0.2
	Ohio	1.0	0.9	2.0	0.5	.....	.....	0.2
	Kentucky	0.5	0.9	2.0	0.7	.....	0.7	0.2
	Tennessee	2.1	0.9	1.0	3.1	0.9	2.2	0.6
	Mississippi	4.1	2.7	.....	3.1	0.5	2.5	1.2
	Alabama	0.5	1.8	3.0	0.6	.....	.....	.....
Zone 7	Quebec	.....	.....	1.0	.....	.....	.....	.....
	New York	.....	.....	.....	.....	.....	.....	0.2
	Pennsylvania	.....	.....	.....	0.06	.....	.....	.....
	New Jersey	.....	.....	.....	0.06	.....	.....	.....
	Virginia	.....	.....	1.0	.....	.....	.....	.....
	North Carolina	.....	.....	.....	0.1	.....	.....	.....
	South Carolina	0.5	0.9	1.0	0.2	0.5	.....	.....
	Georgia	.....	.....	.....	0.4	0.5	.....	.....
	Florida	.....	.....	1.0	.....	.....	.....	.....

niques should be re-applied with larger samples. A much more positive approach to this problem depends on analyses of recovery rates, which can of course be broken down regionally as well as month by month.

BAITED BIRDS AS RANDOMIZED SAMPLES OF REGIONAL POPULATIONS

In summarizing banding recoveries of waterfowl, either in migration studies or game-management analyses, it may properly be asked if adult birds banded by baited trapping represent adequately randomized samples of regional populations. This question is explored in tables 4 and 5 for adult birds banded before September 1 or in some year previous to the one in which they were reported shot. In 9 out of 12 cases, *more Mallards were shot in their "home" state or province than in any other state or province.* In two other cases, divergences from this generalization were minimal. For Saskatchewan-banded birds, Arkansas recoveries equalled those of the home province; for North Dakota-banded birds, they exceeded that of the home state by 0.2 per cent. In the one nonconforming sample (Montana), the banding station was less than 50 miles from the critical state boundary (Idaho). From this I conclude that these banded samples are not typical of large regional or flyway population units of Mallards; each one of them tends to be peculiarly "conditioned" by the birds' previous experience. In the southern part of the Mississippi Valley, we have an Illinois population unit of Mallards, a Missouri one, an Arkansas one, and a Louisiana one. It is obvious that most birds that were trapped for banding purposes in the past were caught because they were baited and spent some time in the vicinity of the banding station. While it is not evident from this study that they returned to that station or its vicinity, it is certainly implied that they tended to return to the same state and that they spent more time there than in neighboring states or were more easily shot in the state or province in which they were banded. This bias is a warning that even with large-scale banding operations, one cannot place complete confidence in unqualified statements that given percentages will appear in particular zones. The fact remains, however, that banded adults are reported with relative consistency in areas away from the point of banding. Thus, in tables 4 and 5, adult birds were reported in Missouri, Arkansas, and Louisiana with the following percentages: from Saskatchewan—4, 11, and 7 per cent; from North Dakota—5, 12, and 7; from Manitoba—6, 9, and 6; and from Minnesota—5, 12, and 6. It seems to me probable that correction factors can be worked out for individual banding stations to remove bias introduced by "conditioning," but I did not attempt any in the present study.

In recent years, the United States Fish and Wildlife Service has utilized drive traps as a means of capturing both young and adult ducks for banding in Canada. By eliminating baiting, this technique opens up a fresh approach to the problem of banding representative samples of waterfowl populations and to analyses of their migratory behavior.

In general, the adult recoveries set forth in tables 4 and 5 conform to the migration analyses of Lincoln (1933) and Hawkins (1949). Contradictory results may be noted in the small number (27) of waterfowl banded in western Montana and recovered in California according to Lincoln (1933:134); I am at a loss to explain his result and am forced to regard it as a *lapsus*. (Some additional data on Montana-banded Mallards are also presented in table 7.) Cartwright's (1945) description of a previously unrecognized migration route from Alberta to California, which was reported for two other species, seems to have been an indirect correction of this oversight. Hawkins' (1949) report that 7 per cent of an Alberta sample of Mallards was recovered in Michigan should have read 0.7 per cent (A. S. Hawkins, *in litt.*).

To Munro (1943), banding and observational data from British Columbia have sug-

gested that "Mallard populations in general are definite associations, nesting in the same localities, migrating together, and wintering together in the same areas from year to year." This hypothesis could not be tested thoroughly in the course of my study. The possibility should also be mentioned that an aggregation of birds nesting in some area in the North may leave there en masse and the individuals proceed to their wintering grounds at different rates of travel. Thus, observations on migration in southern Canada might support Munro's hypothesis of migration by aggregations while observa-

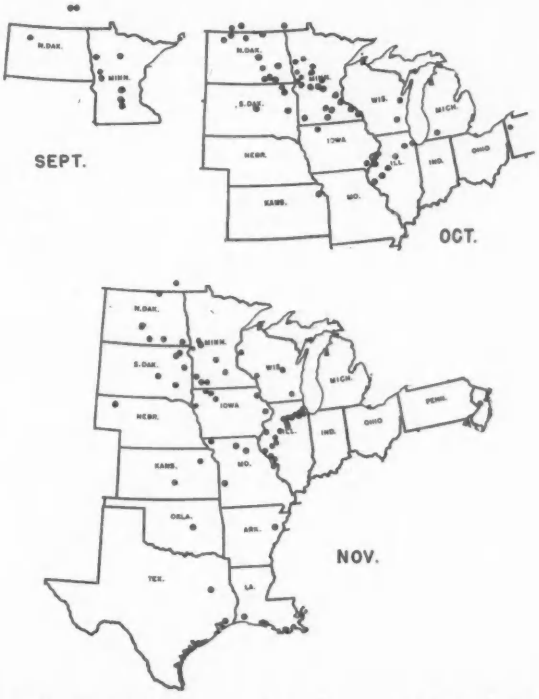

Fig. 2. Geographic distribution of returns of some adult Mallards reported shot in September, October, and November, 1944; all individuals banded in 1943 at McGinnis Slough, northeastern Illinois (Mann, Thompson, and Jedlicka, 1947).

tions in Oregon, Nebraska, and Illinois would contradict it if the birds dispersed more and more as they migrated south.

One test of this hypothesis is illustrated in figures 2 and 3, in which the recoveries of Mallards (banded in northeastern Illinois in 1943) are followed month by month throughout a full hunting season. One should notice here the width of the front on which the birds travelled and the probable duration of the "aggregation" they made up.

Although my initial impression of these maps was that the front was a wide one, I finally concluded that "width" here requires some definition. If one is willing to overlook an aberrant 10 per cent of the population that scatters widely, it can be said that

most of these birds moved within a channel approximately 250 miles wide. This is about the width of Iowa and, for a powerful flyer like the Mallard, this seems to me to be a reasonably narrow migration route. Despite the distortions in the data produced by the length of the legal hunting season, it is evident, however, that these Mallards were strung out in a long arc from Manitoba to the Gulf Coast during the autumn. The final test of migration by definite aggregations in waterfowl perhaps depends on a re-analysis of the data according to the time the birds were banded.

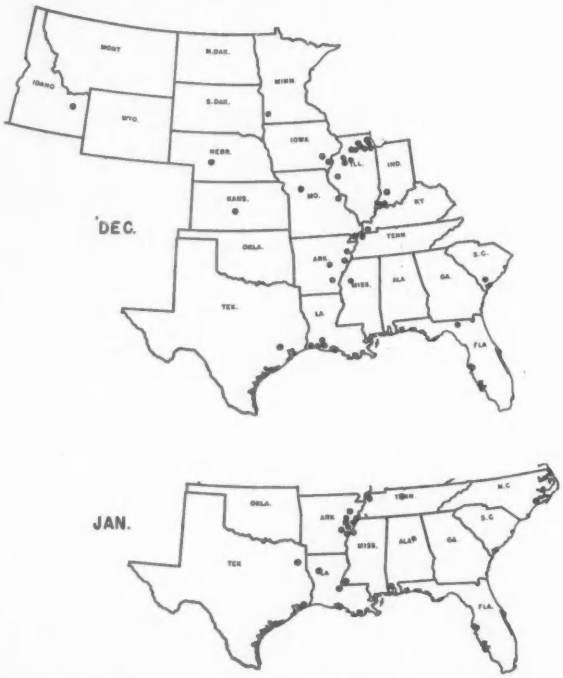

Fig. 3. Distribution of adult Mallards reported shot in December, 1944, and January, 1945. Original data from Mann, Thompson, and Jedlicka (1947), as in figure 2.

It is worth noting that the "conditioning" associated with baited traps is a behavior pattern that shows up in hunting-season records, and its effects should not be expected in spring distributions on birds on their breeding grounds. Table 6 demonstrates this situation. While sampling errors affect the percentages both vertically and horizontally in a table like this, provincial differences in, say, shooting of waterfowl in spring (or reporting of bands) may only affect the distributions horizontally. Sampling errors aside, the ratios implied vertically apparently represent preliminary indices of the distributional gradients existing at these latitudes. To make them statistically reliable, some large-scale banding programs would have to be carried out. In order to give greater meaning to analyses like that of table 6, it would be particularly helpful if these programs could be carried out on wintering populations.

Table 6

Breeding Season Recoveries of Some Winter-banded Mallards

Where banded	Number banded	Per cent recovered in May and June			
		Alta.	Sask.	Man.	Ont.
Kansas-Oklahoma	73	36	42	21	1
Mo., Ark., and La.	55	16	44	34	5
Illinois	149	12	28	43	17

DISTORTIONS PRODUCED BY DIFFERENT BANDING DATES

Aldrich *et al.* (1949:2) have pertinently distinguished between "direct" and "indirect" recoveries. Direct recoveries in their report involve recaptures of birds during the migration period in which they were banded. Since their technique frequently groups birds banded during the breeding season with those banded during the hunting season, it is of some interest to examine the possible effects that banding dates have on the frequency of recoveries reported in various states and provinces. I have attempted to do this by breaking down some recovery data into birds banded before September 1 and those banded after August 31 (table 1). (More divisions of the data would be useful in larger-sized samples.)

Among young birds, significant differences were absent in the two rather small-sized samples examined. Among adult birds, these differences were absent in those from Alberta and present to a minor degree in the Saskatchewan-banded samples studied here. In this last group, birds banded before September 1 appear to have had an equal oppor-

Table 7

Autumnal Distribution of Hunters' Reports of Male Mallards Banded in Montana in 1927

Size of sample	414	254	239
When reported shot	Same year	Later years	See text
Where reported shot	Per cent of reports in each sample		
British Columbia	.....	2.0	.....
Alberta	.....	11.4	.....
Saskatchewan	.....	1.6	.....
Montana	29.2	15.4	18.1
Idaho	29.7	28.3	33.2
Washington	15.2	8.7	10.2
Oregon	16.2	13.0	15.3
California	8.7	14.9	17.5
Miscellaneous	1.0	4.8	5.6

tunity to disperse both east and west as well as to undergo something of a full measure of hunting pressure in the northern tier of states. Those banded after August 31 presumably represented a residue of the birds left in Saskatchewan; they did not disperse appreciably to the east and west, and their lingering in Saskatchewan seems to have subjected them to less hunting pressure in the northern tier of states.

It is of course obvious that, south of Canada, banding dates late in the hunting season should lead to no direct recoveries in Canada. In a purely preliminary exploration of this situation, I separated 414 direct recoveries from 254 indirect recoveries of

668 unaged male Mallards banded by F. H. Rose in western Montana during the fall of 1927. Even when all the Canadian recoveries are dropped from consideration, as in the last column of table 7, several interesting differences between the two types of recoveries compel notice: they are decreases in the percentage of reports for Montana and Washington in indirect recoveries and increases in the percentage reported for California. It seems to me quite probable that these differences arise from the fact that the birds recovered directly were not aged at the time of banding and must have in-

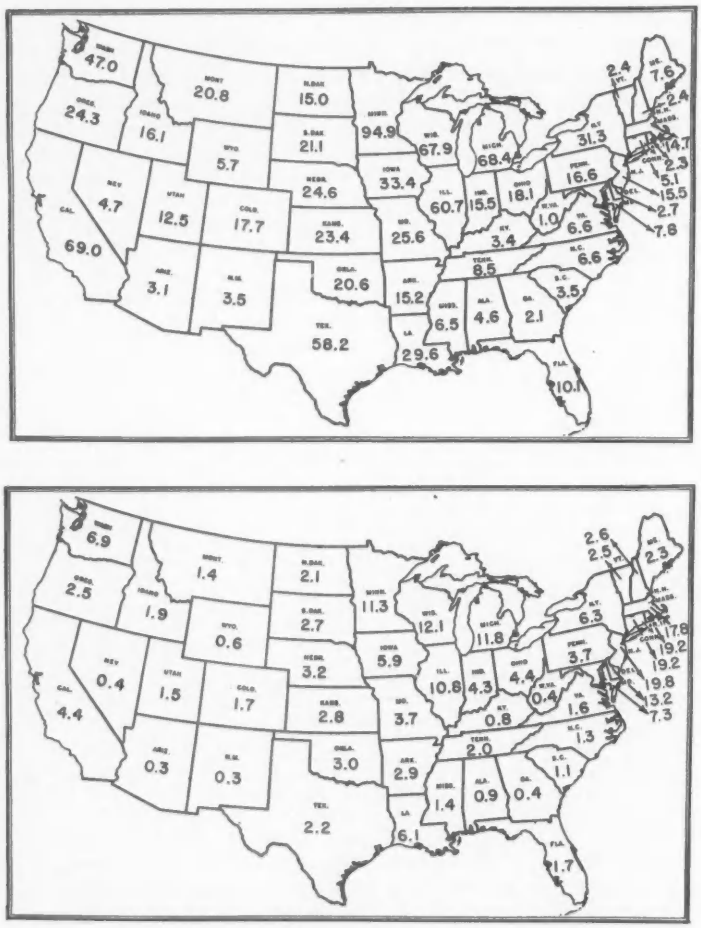

Fig. 4. Upper map, mean number of Federal duck stamps (in thousands) sold annually in each state, 1934–44. Lower map, 10-year duck-stamp sales, 1934–44, divided by the total area in square miles of each state and multiplied by 10.

cluded an important number of young birds. The samples here considered can scarcely be taken as an adequate test of the effect of banding dates, but they do serve to illustrate the degree of variation that can be expected from this source.

DISCUSSION

It is obvious that regional differences in shooting pressure could bias the geographic distribution of waterfowl recoveries. This is using the term shooting pressure not only in the sense of guns afield per unit area, but also as the equivalent of some index of hunting effort or efficiency (the mean number of days afield for each hunter, facilities such as hunting clubs or public shooting grounds, and the like).

One national index of duck-hunting pressure is the number of duck stamps annually sold by the United States government. With the help of unpublished tabulations furnished me by F. C. Lincoln and A. C. Martin, I mapped the mean number of duck stamps sold in each state over a ten-year period, from 1934 to 1944 (fig. 4, upper map).

Differences in the numbers of duck stamps sold in adjacent states are well known and quite considerable. Thus, in Florida and Georgia, nearly identical in size, duck stamps averaged 10,106 for the former and 2109 for the latter over a ten-year period. Illinois has averaged 60,677; Iowa with a similar size has averaged 33,360.

To get some idea of the relative densities of duck hunters, I next divided this mean number by the number of square miles in each state. The resulting distribution is summarized in table 8. The 14 states that averaged the most number of duck stamps per

Table 8

Average Number Duck Stamps Sold Per Square Mile

Number of stamps per square mile	Number of states
Less than 0.1	8
0.11–0.20	10
0.21–0.30	10
0.31–0.40	3
0.41–0.50	3
0.51–1.98	14

square mile from 1934 to 1944 were Iowa, New York, Washington, Maryland, Louisiana, Delaware, Illinois, Michigan, Minnesota, Wisconsin, Massachusetts, Rhode Island, and New Jersey. The geographic spread of these data can be seen in figure 4 where each value has been multiplied by ten. This index of hunting pressure suggests superficially that uncorrected mortality reports of banded waterfowl might minimize the occurrence of ducks in some states like Oregon and exaggerate it in other regions like Minnesota, Wisconsin, Michigan, and Illinois or on the Atlantic Coast from Massachusetts south to Delaware or Maryland.

A few moments' reflection will convince one, I think, that this index is too crude to justify any such inferences without supporting evidence from the field. It is probably quite true that annual fluctuations in duck-stamp sales are useful indicators of changing hunting pressure on waterfowl, but the geographic distribution of these stamps is something more complex. Federal duck-stamp sales in each state are fundamentally mass notices of anticipation to hunt waterfowl. These mass notices result from the availability of promising hunting areas and from the size of the human population in each state. Figure 4 must indirectly reflect the presence of waterfowl concentration areas as well as variations in the distribution of the human population in the United States. Aside from a potential bias associated with the acquisition of duck stamps by philatelists,

these reasons make duck-stamp densities a tenuous and uncertain tool in the analysis of waterfowl banding recoveries. A much more pertinent correction factor would seem to be the density of human population in each state.

Other banded birds that apparently are shot mostly by duck hunters include the Double-crested Cormorant (*Phalacrocorax auritus*) and the White Pelican (*Pelecanus erythrorhynchos*). For recoveries of these species, the above arguments clearly do not

Fig. 5. Left, distribution of Double-crested Cormorants banded in Saskatchewan and later reported in the fall hunting season. Right, same data divided by the density of duck-stamp sales as shown in figure 4 (lower map).

hold, and for them duck-stamp analyses would seem to be pertinent. In figure 5, I have mapped some autumnal reports of Double-crested Cormorants banded by Fred G. Bard in Saskatchewan and later reported shot (by persons who may or may not have been hunters). The west to east gradient effect appears among the corrected recoveries in four out of six instances, minimizing the frequency of birds shot in Minnesota and in the states east of the Mississippi River. It seems to me that the adjusted distribution of these recoveries has fully as much plausibility as that of the raw data, but both analytical techniques leave much to be desired in the test here considered.

SUMMARY AND CONCLUSIONS

A review of over 6800 autumnal recoveries of the Mallard in North America develops the following points:

1. Relative geographic distributions (state and provincial frequencies expressed as a per cent of all recoveries reported) are more biased when young birds are included in the samples being studied than when adults alone are considered. The early-season vulnerability of these immature birds to hunting exaggerates their relative distribution in the North and underestimates their presence in the South.

2. In years subsequent to their banding, more Mallards have been shot in their home state or province than in any other state or province; samples of these waterfowl studied thus far have been trapped by baiting and do not appear to be randomized samples of large regional populations.

3. The hypothesis that Mallard populations in general are definite associations re-

mains unproven; in one sample banded in Illinois most of the birds migrated on a front about 250 miles wide.

4. Percentage distributions of "direct" recoveries will vary at least occasionally according to the dates on which the birds were banded.

5. As Munro (1943) has indicated, less than 6 per cent of the adult Mallards marked in British Columbia (banded mostly near Chilliwack) are shot south of Washington; this is in contrast to about 25 to 30 per cent of a sample banded in western Montana. There evidently are at least two major population units of this species on the Pacific Seaboard.

6. Small samples of Mallards recovered in the Prairie Provinces in May and June suggest that Mallards from Alberta pass through or reach Kansas-Oklahoma, Missouri-Arkansas-Louisiana, and Illinois in the proportions of 4, 2, and 1; for Saskatchewan birds these ratios are roughly 4, 4, and 3; for Manitoba birds, 2, 3, and 4; and for Ontario Mallards, 1, 5, and 15.

7. While the geographic distribution of banded cormorants and pelicans reported shot in the fall apparently can be corrected for regional differences in hunting pressure as indicated by Federal duck stamp sales, similar data for waterfowl can not.

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FROM FIELD AND STUDY

The Brown Booby (*Sula leucogaster brewsteri*), adults and young at nest. Photograph taken on April 23, 1949, on George Island, in the Gulf of California, Mexico, by Ed Harrison and Frances Roberts.

Post-mortem Color Change in Bird Specimens.—Recently while working up a considerable collection of Fox Sparrows from Alaska, we had opportunity to compare a series of recently collected specimens with others that had been taken in the same localities on approximately the same dates (seasonally) fifty or more years ago. In doing this, we quickly reached the conclusion that it was useless to attempt to identify newly collected birds by comparing them with these older specimens.

We had available for use Ridgway's types of *Passerella iliaca fuliginosa* taken on June 10, 1897; *P. i. insularis* collected May 17, 1868; and *P. i. annectens* taken June 20, 1899. In addition to these types, we had a number of specimens of *P. i. fuliginosa* from or near the type locality that were 50 years old; a number from Kodiak that were taken before 1900; and a series from Yakutat Bay taken between June 19 and 23, 1899. A number of skins of *P. i. unalascensis* taken between 1885 and 1903 were also available together with an excellent series of *P. i. townsendi* taken between 1866 and 1908 from known breeding areas. The older material of *P. i. sinuosa* was less satisfactory, but we did have skins collected as early as 1920.

For comparison, we had a fine series of breeding birds from the type localities or from the same breeding localities and which had been taken on approximately the same seasonal dates as the older specimens. These were all taken between 1940 and 1950, largely in the period from 1943 to 1950.

When the older specimens were arranged according to geographic sequence and the more recently taken birds arranged in comparable order, the amount of foxing or color change was striking. It was apparent that although the newer specimens fitted the original descriptions, the types or older specimens from type localities did not. As we worked with them, notes were made of the differences in the colors of the backs in the two series when checked with Ridgway's color key. Believing that these notes will be of interest to other workers, they have been condensed and arranged by subspecies, as follows:

P. i. townsendi.—The type was not available, but a winter bird from the same locality on the Columbia River and now in the United States National Museum is considered a co-type. The color of the back of this bird is Prout's Brown, while recently taken fall and winter specimens vary from

Burnt Umber to Van Dyke Brown. A series of old skins from breeding areas vary from Warm Sepia to Bister, while recently taken birds from the same areas at comparable dates are Prout's Brown to Mummy Brown. This race showed the most marked color changes.

P. i. fuliginosa.—The type of this race is a breeding bird taken on June 10, 1897, at Neah Bay, Washington. Its color is close to Bister, although the series of older skins is between Raw Umber and Mummy Brown. Newer skins (1944), however, are Chestnut Brown.

P. i. annectens.—The old series (including the type) is close to Raw Umber, but for newly taken birds the color varies from Prout's Brown to Mummy Brown.

P. i. sinuosa.—The back color of the older skins is Raw Umber, although for those more recently taken it is Fuscous or very close to this shade.

P. i. insularis.—Back color of the fine series of older skins (including the type) is Raw Umber, but newly collected birds are Olive Brown.

P. i. unalascensis.—Older specimens are Natal Brown, while recently taken birds are slightly grayer than Olive Brown but still as close to it as to any other color.

It is obvious that specimens of the browner races have foxed somewhat more than have those of the grayer forms, but all show a tendency to increase in redness. The specimens in this group now have little value for comparative purposes unless they are used with skins of about equal age. Nevertheless, when newly collected birds of about equal age are compared, the races separate in the same sequence that is obtained when this is done with the older specimens.

In identifying birds of other species from coastal Alaska, we have watched carefully, but thus far have not found so marked a change for any other species. It is true that older skins of Song Sparrows collected from Yakutat Bay south to Washington show foxing to some degree, but the grayer forms to the westward do not show so marked a change of coloration. In none of the races of the Song Sparrow except in *Melospiza melodia caurina* and *M. m. rufina* is the change great enough to interfere with comparison for purposes of identification.—Ira N. Gabrielson, *Wildlife Management Institute* and Frederick C. Lincoln, *U. S. Fish and Wildlife Service, Washington, D.C., March 29, 1951.*

Migrants and Introduced Species in the Palau Archipelago.—Mr. Peter J. R. Hill, who served as Resident Naturalist for the Pacific War Memorial in the Palau Islands for some time, also made a collection of vertebrate and invertebrate forms for the Peabody Museum during the latter six months of his stay in 1950. Among the birds are several migrant or introduced species which may be mentioned as being of general interest in our knowledge of the fauna of these islands.

Sula leucogaster plotus. The Brown Booby has not actually been recorded from the Palau area, so it is worth noting that Mr. Hill obtained a specimen weighing approximately 633 grams, within the reef off Babelthuap Island.

Rallina euryzonoides euryzonoides. A male and female of this species were collected on Koror and Ngurukdapel islands in June and November. The birds were not in breeding condition. Comparison shows them to belong to the Philippine form. The male weighed 118, the female, 99 grams.

Cuculus fugax hyperythrus. A solitary male taken in February on Babelthuap Island is a new record for the archipelago. The bird weighed 92.5 grams.

Cacatua galerita triton. Two females taken on Ngurukdapel and Aulupsechel islands belong to the New Guinea race. They weighed 488 and 491 grams and were in forest, in one case one of a pair, in the other, one of a flock of four. One bird was coming into breeding condition. This evidence would indicate that Cockatoos are spreading in the Palaus and breeding there. Marshall (Condor, 51, 1949: 221) recorded Cockatoos on Koror.

Larius roratus pectoralis. A solitary male New Guinea Eclectus Parrot was taken on Aulupsechel Island in May. It weighed 455 grams. Hill reports in his notes seeing a flock of ten of these birds, including green males and the red females, on Ngurukdapel Island in March, 1950, so possibly these stray captive birds have become established as a second breeding species of Psittacidae in the Palau group.

Lonchura ferruginosa (near *formosana*). The Chestnut-bellied Munia is apparently breeding in the Palaus. Specimens including an immature male were taken on Babelthuap and Koror. This is possibly a hybrid population as might be expected in released cage birds. A female and young bird are near *formosana*, the adult female particularly in having the occiput and nape dark brown rather than black. An adult male on the other hand has the entire head black as in *rubronigra*.

Lonchura punctulata (near *cabanisi*). A non-breeding male was collected April 26 on Koror from a flock of eight.—S. DILLON RIPLEY, *Peabody Museum of Natural History, Yale University, New Haven, Connecticut, May 16, 1951.*

The Tyrannid Aechmolophus mexicanus in Guerrero.—The small Mexican flycatcher of uncertain affinities, *Aechmolophus mexicanus,* described in 1938 by J. T. Zimmer (Auk, 55, 663-665), is known in the literature from only two specimens. These are the type (a male) in the American Museum of Natural History and a second specimen (female) in the United States National Museum (Zimmer, Auk, 56, 1939:189). Both were obtained at Cuernavaca, Morelos, at 5000 feet, on April 9, 1908, by A. P. Smith.

A third specimen is now reported from the Milton S. Ray collection of Guerreran birds at the Museum of Vertebrate Zoology. It is a male ("testes ¼ enlarged") obtained by W. W. Brown at or near Chilpancingo, Guerrero, on October 26, 1940. The altitude at Chilpancingo is approximately 4400 feet. Wing and tail measure 65.5 and 66.9 mm., respectively. The collector's label bears the notations "iris brown" and "mandible completely yellow." This specimen (Mus. Vert. Zool. no. 111278) was compared directly with the type in New York in November, 1950. The known range of *Aechmolophus mexicanus* is thus extended southward into central Guerrero. This note is written primarily to make the record available for two separate comprehensive reviews of Mexican tyrannids now in progress, but I hope also that it will stimulate further search for this little known species.—FRANK A. PITELKA, *Museum of Vertebrate Zoology, Berkeley, California, March 5, 1951.*

A New Bird for Idaho.—On July 11, 1949, Earl J. Larrison and the writer observed a Mockingbird (*Mimus polyglottos*) while driving along the south end of Grays Lake, Caribou County, Idaho. The bird flew across the road and into an aspen grove. No effort was made to collect it at the time. We looked for it the next day without success.

On December 31, 1950, a male Mockingbird was collected in an orchard at the southwest end of Lowell Lake, 4 miles northeast of Marsing, Canyon County, Idaho. Apparently this is the first specimen to be taken in the state.

Behle (Condor, 46, 1944:80) listed this species for Utah as "Statewide resident in summer in valleys." Its occurrence in Idaho is that of an accidental but it may occur fairly regularly in the valleys of southeastern and southcentral Idaho in summer.—MALCOLM JOLLIE, *University of Idaho, Moscow, Idaho, March 10, 1951.*

Nomenclature of the Hooded Jay: a Correction.—In a recent paper on Central American races of the Hooded Jay (Condor, 53, 1951:97-98), the name *mitrata* was erroneously applied by me to the group of four races there newly set forth as a specific unit in the genus *Cyanolyca*. The earliest known population, belonging to the northernmost race, now bears the name *mitrata* (Ridgway, Auk, 16, 1899:255); but this is not the oldest available name among the four races, a fact called to my attention by Mr. Eugene Eisenmann. *Cyanolyca mitrata* was proposed in 1899 when the original name *ornata* (Lesson, Rev. Zool., 2, 1839:41) was found to be preoccupied, and *Cyanocorax cucullata,* proposed in 1885 for the Costa Rican and Panamanian populations (Ridgway, Proc. U. S. Nat. Mus., 8:23), provides the correct specific name for the Hooded Jay as delimited in the paper cited above. The nomenclature of the four races of *Cyanolyca cucullata,* north to south, must therefore stand as follows:

Cyanolyca cucullata mitrata Ridgway, 1899
Cyanolyca cucullata guatemalae Pitelka, 1951
Cyanolyca cucullata hondurensis Pitelka, 1951
Cyanolyca cucullata cucullata (Ridgway), 1885

—FRANK A. PITELKA, *Museum of Vertebrate Zoology, Berkeley, California, April 30, 1951.*

The Chinese Spotted Dove at Bakersfield, California.—The Chinese Spotted Dove (*Streptopelia chinensis*) has been known in California since 1917 when it was already "common" in northern Hollywood, a suburb of Los Angeles. By 1921 it was "firmly established" over a considerable part of Los Angeles City (Wyman, Calif. Fish and Game, 7, 1921:180). By 1933 it had spread east to Pasadena and Alhambra, and west and south to Santa Monica and Inglewood, and by 1941 had become established as far east as Redlands, Riverside County (Grinnell and Miller, Pac. Coast Avif. No. 27, 1944:567).

In the summer of 1946, while working for the United States Public Health Service in Bakersfield, California, Dr. H. E. McClure and I repeatedly observed these doves, nestlings as well as immature birds and adults, in and about the city in yards and parks, but never in the surrounding arid farm lands. Continuing our studies for your years, we found the species to be a common resident of the city.

This further extension of the range of the Chinese Spotted Dove in California might have been inaugurated either by introduction or by movement into the area from the southward. The first method would seem the more likely, and indeed we have been told by various residents that the doves were introduced, although no one could tell us when or by whom. The latter method would have meant that the birds would have had to cross the Tehachapi Mountains which enclose the southern end of the San Joaquin Valley. The lowest passes in this range are Tehachapi Pass, elevation 3800 feet, coming in from the Mojave Desert on the eastward, and Tejon Pass, elevation 4239 feet. Tejon Pass lies almost in a direct line between the Los Angeles area and Bakersfield, which is approximately 100 miles north of Los Angeles. In several different periods of observation during this time at various points along U. S. Highway 99 through Tejon Pass, no Chinese Spotted Doves were observed.

Regardless of how it may have reached Bakersfield, the Chinese Spotted Dove is well established there and it seems quite likely that this species may eventually spread even farthur northward in the San Joaquin Valley.—RONALD T. REUTHER, *El Cerrito, California, March 1, 1951.*

An Ancient Murrelet Goes Inland.—On the afternoon of November 18, 1950, Jim Long, a railroad employee, found a "strange" bird on the ground between the railroad tracks near the roundhouse of the Oregon Trunk Railroad in the suburbs of Bend, Deschutes County, Oregon. I received this bird, very much alive, on the morning of November 19; however, it died later that day. Much to my surprise it proved to be an adult female Ancient Murrelet (*Synthliboramphus antiquus*). It was very fat and in fine early winter plumage. The stomach was entirely empty.

The reason for the occurrence of this pelagic species so far from the sea, about 120 miles, and east of both the Coast and Cascade ranges of mountains, is possibly found in this statement from the United States Weather Bureau. "Storm conditions prevailed here three days prior to the finding of *S. antiquus,* with a strong wind checked at 50 miles per hour, in gusts at the air port. Our heavy storms move in from the North Pacific in great cyclonic patterns."—STANLEY G. JEWETT, *Portland, Oregon, January 8, 1951.*

Body Temperature and Breathing Rate in a Nighthawk.—In view of the apparent cases of hibernation in the Poor-will (Culbertson, Condor, 48, 1946:158-159; Jaeger, Condor, 50, 1948: 45-46, and 51, 1949:105-109), information on temperature rhythm in the Caprimulgidae is desirable.

Between July 15 and 18, 1950, I kept captive an immature but nearly full-grown Nighthawk (*Chordeiles minor*), which was given to me by Laymond M. Hardy. The bird weighed 46.1 grams and had a wing length of 177 mm. The weight of fully adult males of the Florida race (*chapmani*) is 56.1-65.6 grams, and the wing length is 178-192 mm.

Body temperature records were made by inserting a mercury thermometer well into the large intestine. Sixteen daytime readings were taken between 5:25 a.m. and 5:30 p.m. Times are given in local civil time, which at Gainesville, Florida, is 29 minutes behind standard time. The mean daytime body temperature was 106.27° F., with a minimum of 105.1° F. at 4:35 p.m., and maxima of 107.1° F. at 5:25 a.m. and 3:10 p.m. Wetmore (Smith. Misc. Coll., 72 (12), 1921:39) gave a reading of 106.2° F. for a male of this species, presumably obtained during the daytime.

Two night readings were secured at 7:35 and 11:50 p.m. The respective body temperatures were 107.2 and 107.6° F., the mean being 107.4° F.

Average sunrise at Gainesville during the period of observation occurred at 5:09 a.m. The sun set at 7:03 p.m. Maximum and minimum air temperatures were 93° F. and 67° F.

The number of breaths per minutes averaged 77 for seventeen diurnal observations, with extremes of 52 and 113. Two night records were 72 and 80 breaths per minute, the mean being 76. Thus as far as these limited observations go, there was practically no difference between day and night breathing rates. On the other hand, maximum body temperature occurred at night, the reverse of the condition obtaining in diurnal species. Miller (Condor, 52, 1950:41-42) has presented evidence that a similar condition holds in the Poor-will, and Wetmore (*op. cit.*) and Simpson and Galbraith (Jour. Physiol., 33, 1905:225-238) report the same temperature reversal in owls.—PIERCE BRODKORB, *Department of Biology, University of Florida, Gainesville, Florida, March 13, 1951.*

Cock Roosts of Nighthawks.—Pickwell and Smith (Condor, 40, 1938:196-197), while studying the nesting habits of the Lesser Nighthawk (*Chordeiles acutipennis*) on the dry channel of the Coyote River in the Santa Clara Valley of California, frequently flushed groups of two or three adult males from an area which they called the "cock roost." In only one case was a male observed to have established a roosting location within the nesting territory of an incubating female. What relationship the separate congregation of males had with the nesting females was not determined. Subsequently, van Rossem (Condor, 47, 1945:170) related his experiences with "cock roosts" of the same species; these included the observation of an undetermined number of males roosting in a willow grove at Buena Vista Lake, California, on June 21, 1921. He revisited the same grove on June 19, 1922, at which time 12 or 15 males were present. Two males collected from the flock during his first visit were not in breeding condition, and, probably largely as a result of this circumstance, van Rossem suggested that such roosts "are composed in part at least, and possibly altogether, of unattached, non-breeding birds." Our field experiences with the Common Nighthawk (*Chordeiles minor*) indicate that gregarious roosting assemblages of males are of common occurrence and that such behavior may be normal for breeding as well as non-breeding individuals.

During the period from July 29 to August 2, 1950, the writers, accompanied by Richard B. Selander, made a trip to southwestern Idaho in an attempt to obtain examples of the recently proposed race *C. m. twomeyi* (Hawkins, Condor, 50, 1948:131-132). At 10:00 a.m. on August 1, we arrived at Walters Ferry, a small community located on the northeast side of the Snake River, at an elevation of 3000 feet, five miles southwest of Melba, Canyon County. The region is semi-desert with extensive flat areas of sagebrush (*Artemisia*) and greasewood (*Sarcobatus*) extending from the river in both directions for several miles, and a few clumps of willows (*Salix*), cottonwoods (*Populus*), and black locusts (*Robinia pseudoacacia*) scattered along the banks. Nighthawks were not flying at the time, but we recognized the area as one likely to be inhabited by these birds. We were informed by a local resident that nighthawks were indeed abundant in the area and were directed to a mixed stand of cottonwood and black locust trees about 1800 square feet in extent, located a short distance from the river. Here we found an estimated 100 nighthawks roosting on the more horizontal branches. They were perched lengthwise in typical nighthawk fashion and apparently were asleep, since they seemed undisturbed by our presence. Despite the fact that the birds were well camouflaged against the bark and foliage, we had no difficulty in obtaining 16 individuals, all of which proved to be adult males. With the discharge of our shotguns, a small flock of the birds rose in the air where they began circling over and through the trees. They seemed reluctant to leave the roosting area, and many of them that took to wing returned to perch in the trees. Others drifted out over the river and fields, where some apparently began to feed. All the birds observed up to this time were adult males. At no time did the birds utter call notes or other vocal sounds. We wished to obtain a few females in order to complete our series, but had difficulty in finding many either in the circling flock or among those birds still perched. After a careful search, however, we collected three females, all adults. Although one of these was definitely known to have been roosting in the grove, it is possible that the others were disturbed from nearby nests since they were taken while flying. In any case, the roosting flock was composed almost entirely of adult males.

The testes of the 16 adult males averaged 4 mm. in length, with extremes measuring 3 and 7 mm., respectively. Other adult males collected at Junction Reservoir, Boxelder County, Utah, on July 30, 1950, and at various localities in southwestern Idaho on July 31 of the same year had testes of approximately the same size as those from Walters Ferry, and it therefore appears that these latter males were normal as regards gonadal development. Our records show that at maximum (?) development in June the testes of this species enlarge to about 8 mm. The ovaries of the three females collected were reduced in size, with the largest ovum of each measuring 1 mm. Again, our data indicate that this is the normal size for that particular time of the year.

According to Mr. Dale Bradley, who had lived at or near Walters Ferry for a number of years, nighthawks arrive in that region in the latter part of May and are seldom seen after September. Rust (Condor, 49, 1947:184, 187) noted that, over a 36-year period, nighthawks generally arrived in the Coeur d'Alene region of northern Idaho during the first two weeks of June and usually began fall migrational movements during the last week of August or the first part of September. Mr. Bradley also informed us that this particular group of trees was used as a roosting place throughout the summer months, and that, to the best of his knowledge, the size of the flock remained fairly constant

during that time. He mentioned that he had observed a similar concentration of nighthawks near a ranch at Reynolds Creek, 14 miles southwest of Walters Ferry, at an elevation of approximately 4000 feet.

During the time of our stay in Idaho, the females must have been brooding the young since no immature birds were seen. During feeding flights observed at Glenns Ferry, Hagerman, and Mountain Home, females began flying late in the evening after the males had been feeding for some time. Late flying is seemingly a characteristic behavior of incubating and brooding females (Higgins, unpublished Master's Thesis, Univ. Utah, 1948:21; Rust, *op. cit.*: 185).

Another "cock roost" was found on July 31 at Buhl, Twin Falls County, Idaho, where a group of about 50 males was roosting in a large pile of dead trees. We were first attracted to this roost by seeing a few birds flying over the area at 1:00 p.m. In this case also, the birds were silent and seemed reluctant to leave the roost when disturbed. Six males collected had testes averaging 5 mm. in length.

Selander observed a group of 10 to 15 nighthawks (sex not noted) roosting in a cottonwood tree near Utah Lake, Utah County, Utah, on June 26, 1944, and again on August 11 of the same year. During the past few years, we have seen numerous small groups of these birds perched on telephone poles and fences in various parts of northern Utah.

In desert areas where trees or other such roosting sites are not available, it has been our experience that the birds do not congregate in large roosting flocks. In such regions, nighthawks generally feed in small groups and at sunset have been observed to fly low over the ground and scatter before alighting to roost for the night.

Our information suggests that, at least for western interior populations of *Chordeiles minor*, the establishment of "cock roosts" is a normal behavior pattern. In areas of dense nighthawk populations where a minimum of elevated roosting locations is available, large concentrations occur, but even in thickly wooded places the males sometimes exhibit a propensity for gregarious roosting.

Unfortunately, we were unable to remain at Walters Ferry or Buhl and thus definitely determine the relationship of the roosting males with the nesting females. The presence of females in one of the flocks indicates that birds of that sex not occupied with nesting activities may join the male aggregations. As shown above, the males collected were in breeding condition. There is the possibility that the flocks were composed largely of birds which had failed to find mates earlier in the year. Rust (*op. cit.*: 177-178) mentioned males which apparently were unable to find mates in the spring and continued mating behavior until mid-summer. He observed that, after mating, "the female invariably selects the nesting area . . ." and ". . . the male selects a roost in a near-by tree." However, in view of the large numbers of males comprising the flocks we have observed, we are inclined to believe that "cock roosts" are, in the main, composed of attached, breeding birds, although non-breeding individuals of both sexes may be present in these gatherings.—ROBERT K. SELANDER, *Department of Biology, University of Utah,* and SHERMAN J. PREECE, JR., *Department of Botany, State College of Washington, February 23, 1951.*

A Fatal Meal for a Young Robin.—During the spring of 1950 a pair of Robins (*Turdus migratorius*) nested on a brace under the cornice of my home in Portland, Oregon. A brood of four young left the nest on May 19. While working in my garden the next morning I was attracted by a weak and muffled call of a young bird in nearby thick vegetation. Investigation soon resulted in finding a young Robin. Protruding from its bill was about five inches of thick cotton cord. A quantity of fresh blood was on its bill and extended about two inches down the cord. I tried gently to remove the cord from the bird's mouth and throat but found it so firmly lodged that I gave up the effort. Placing the bird in a sheltered spot I awaited developments. In about two hours I found the bird dead. A post mortem examination was performed in which the cord was found to be 22 inches in length. The walls of the stomach were much extended and showed two ruptures and the body cavity held a quantity of blood. Due to moisure in the throat and stomach the cord had swollen to nearly twice its size as shown after being washed and dried.

I have seen adult Robins kill and carry off garter snakes eight or ten inches in length. Did this young Robin think the 22 inches of cord was a giant angle worm or a snake?—STANLEY G. JEWETT, *Portland, Oregon, January 8, 1951.*

NOTES AND NEWS

Chester C. Lamb of Irapuato, Guanajuato, Mexico, veteran field collector in the western United States and Mexico, member of the Cooper Ornithological Club since 1899.

The frontispiece of this issue shows the Yellow-breasted Chat (*Icteria virens*) as painted by Andrew Jackson Grayson in Tepic, Nayarit, Mexico, in 1865. The plant shown is composite, consisting of a bird-of-paradise flower (*Strelitzia reginae*) endemic to the cape region of South Africa and grown in Mexican gardens and leaves resembling the common arrow-weed which may belong to a native species. This reproduction is a gift of the James Irvine Foundation in commemoration of the Society of California Pioneers, to which Grayson belonged.

The Southern Ornithological Society was established at Gainesville, Florida, on September 29, 1951. The purposes of the society are to stimulate interest and to promote research in the science of Ornithology. Dr. Pierce Brodkorb was elected president; Julian Baumel, vice-president; David Karraker, secretary; and Earl C. May, treasurer.

In June, 1951, the first five grants of Frank M. Chapman Memorial Fellowships for ornithological research were made by the American Museum of Natural History from the income of the Frank M. Chapman Memorial Fund. The amount distributed totaled $1950, and the recipients and their respective projects were as follows: Richard B. Fischer, Cornell University, a study, based upon banded birds, of the reproductive behavior of the Chimney Swift in central New York State; Byron E. Harrell, University of Minnesota, faunal and ecological investigations of bird life in southern Tamaulipas, Mexico; Owen A. Knorr, Colorado College, life-history studies of the Black Swift in the Rocky Mountains; Mrs. Robert Schultz, University of Washington, the life-history of the Glaucous-winged Gull; and David K. Wetherbee, Clark University, research on the pterylosis of North American birds.

Additional grants from the Chapman Memorial Fund may be made in the spring of 1952. In general, the needs of student investigators will be given preference over those of candidates already possessing widely recognized scientific prestige. Applicants should clearly state their problems and their qualifications. They should likewise be sponsored by one or more of their professors. The requests should be addressed to the Frank M. Chapman Memorial Committee, American Museum of Natural History, Central Park West at 79th Street, New York 24, New York. They should be received not later than January 31, 1952, in order that decisions may be made well in advance of the summer vacation period.

COOPER CLUB MEETINGS

SOUTHERN DIVISION

MAY.—The monthly meeting of the Southern Division of the Cooper Ornithological Club was held on May 29, 1951, in the Allan Hancock Foundation, University of Southern California, Los Angeles. The following names were proposed for membership: Richard O. Bender, Cobb's Mill Road, R.D. No. 1, Bridgeton, New Jersey, by D. E. Groner; Donavan Lee Clark, 1636 N. Alvarado, Los Angeles 26, Calif., by T. R. Howell; Claude T. Adams and Gideon E. Nelson, Jr., both of the Dept. of Biology, University of Florida, Gainesville, Florida, by Pierce Brodkorb; Mrs. Lynn Bramkamp, 260 Wildwood Ave., Piedmont 10, Calif., and Lyle C. Herbst, 10309 La Grange, West Los Angeles 25, Calif., by C. V. Duff.

The meeting adjourned to a preview of rare and early ornithological publications arranged by the Hancock Library in celebration of the Audubon Centennial.—DOROTHY E. GRONER, *Secretary*.

INDEX TO VOLUME 53

A

Acanthis flammea, 146
  flammea flammea, 244
Accentor, 207
Accipiter albogularis gilvus, 84
  cooperii, 136, 184, 232
  gentilis, 136
  gentilis atricapillus, 231
  novaehollandiae rubiane, 83
  striatus, 136
  striatus velox, 232
Acridotheres tristis, 34, 39
Acrocephalus familiaris, 41
  kingi, 41
Actitis hypoleucos, 83, 85
  macularia, 138, 191, 234
Aechmolophus mexicanus, 300
Aechmophorus occidentalis, 134, 229
Aegolius acadicus, 140, 154
  acadicus acadicus, 122, 236
Aëronautes saxatalis saxatalis, 236
Agelaius phoeniceus, 105-115, 145, 234
  phoeniceus fortis, 234
  phoeniceus nevadensis, 234
  phoeniceus sonoriensis, 234
  tricolor, 111
Aimophila cassinii, 245
  ruficeps, 53, 118-119, 122
  ruficeps obscura, 118
Aix sponsa, 136, 209-220, 231
Akepa, 35
Alauda arvensis, 39
Albatross, Black-footed, 35
  Laysan, 35
  Short-tailed, 35
Alcedo atthis salomonensis, 88
Alectoris graeca, 51, 233
Amakihi, 35
Amaurornis olivaceus, 84
Amblycercus holosericeus, 18
Ammodramus savannarum, 153
  savannarum pratensis, 245
Amphispiza belli, 245
  belli canescens, 245
  belli nevadensis, 245
  bilineata deserticola, 245
Anas, 205
  acuta, 135, 205
  acuta tzitzihoa, 230
  carolinensis, 230
  crecca, 135
  cyanoptera, 135
  cyanoptera cyanoptera, 230
  discors, 135, 157, 230
  platyrhynchos, 135, 205, 284-297
  platyrhynchos platyrhynchos, 230
  strepera, 135, 230
  wyvilliana laysanensis, 41
  wyvilliana wyvilliana, 37, 41
Ani, Groove-billed, 10, 16
  Smooth-billed, 10
Anoüs, 85
  minutus melanogenys, 39
  stolidus, 40
  stolidus pileatus, 39, 41
Anser albifrons, 135, 155, 230
Anthus spinoletta, 143
  spinoletta pacificus, 241
Apapane, 34
Aphelocoma coerulescens, 52, 122, 142, 179, 239, 260
  coerulescens insularis, 119
  coerulescens nevadae, 239
  coerulescens superciliosa, 239
  coerulescens woodhouseii, 239
Aplonis cantoroides, 83, 84, 91
  grandis, 83
  grandis grandis, 92
  metallicus nitidus, 92
Aquila chrysaëtos, 136, 178-179
  chrysaëtos canadensis, 232
Archilochus alexandri, 52, 198-201, 236
Ardea herodias, 134, 229, 260
  herodias hyperonca, 229
  herodias treganzai, 229
Arenaria interpres, 85, 191
  interpres interpres, 38
  interpres morinella, 234
  melanocephala, 192
Arremonops rufivirgatus, 18
Asio flammeus, 140, 262
  flammeus flammeus, 236
  flammeus sandwichensis, 39, 41
  otus, 140
  otus wilsonianus, 236
Asyndesmus lewis, 140, 237
Auriparus flaviceps acaciarum, 239
Avocet, 187-189, 193, 235, 256
Aythya, 136
  affinis, 231
  americana, 231
  collaris, 47, 51, 136, 231
  marila nearctica, 231
  valisineria, 136, 231

B

Bartholomew, George A., and Hubbs, Carl L., persistence of a rare color aberration in the Heermann gull, 221
Balanosphyra formicivora, 140, 180
  formicivora bairdi, 122, 237
Baldpate, 51, 135, 157, 231
Basileuterus culicivorus brasherii, 18
Baumgardt, John H., yellow-billed cuckoo in the San Bernardino Mountains, California, 207
Becard, Rose-throated, 18
Beidleman, Richard G., recent bird records from northeastern Colorado, 260

Berger, Andrew J., nesting density of Virginia and Sora rails in Michigan, 202
Bishop-bird, 111, 113
Bittern, American, 135, 229
Least, 229
Blackbird, Brewer, 102, 145, 243
Red-winged, 105-115, 123, 145, 243
Yellow-headed, 111, 113, 145, 243
Blake, Charles H., biographical note on Scopoli, 47
Bleitz, Don, nest of pygmy nuthatches attended by four parents, 150
Bluebird, Mexican, 143, 180, 241
Mountain, 123, 143, 241
Western, 53
Bobolink, 243
Bob-white, 137
Bombycilla cedrorum, 144, 241
garrulus, 143
garrulus pallidiceps, 241
Bonasa umbellus, 137
Booby, Blue-faced, 36
Brown, 36, 298, 299
Red-footed, 36
Bond, R. M., pigeon hawk catching dragonflies, 256
Botaurus lentiginosus, 135
lentiginosus peeti, 229
Brant, Black, 123, 230
Branta albifrons, 47
bernicla nigricans, 230
canadensis, 135, 230
canadensis leucopareia, 230
canadensis minima, 230
canadensis moffitti, 230
canadensis occidentalis, 135, 230
Brattstrom, Bayard H., and Sams, James R., the Clark nutcracker in San Diego County, California, 204
Brodkorb, Pierce, body temperature and breathing rate in a nighthawk, 301
Bubo virginianus, 139, 236, 262
virginianus lagophonus, 236
virginianus occidentalis, 236
virginianus pacificus, 236
virginianus pallescens, 236
Bucephala albeola, 136, 157, 231
clangula, 136
clangula americana, 231
Bufflehead, 136, 157, 231
Bulweria bulwerii, 36, 40, 41
Bunting, Blue, 18
Indigo, 100, 244
Lark, 99, 244
Lazuli, 145, 179, 244
Snow, 114
Bush-hen, 84
Bush-tit, 52, 119, 142, 179, 239
Buteo jamaicensis, 51, 136, 151, 153, 178
jamaicensis calurus, 122, 232
lagopus, 156
lagopus s. johannis, 232, 257
lineatus, 155
regalis, 232, 257
solitarius, 41
swainsoni, 136, 178, 232
Butorides striatus solomonensis, 83
virescens, 134
virescens anthonyi, 229

C

Cacatua ducorpsi, 87
galerita triton, 299
Cacique, Prevost, 18
Cacomantis variolosus addendus, 87
Calamospiza melanocorys, 99, 245
Calcarius lapponicus alascensis, 247, 262
Calidris canutus, 158, 192, 234
Callipepla, 24, 204
Calospiza chrysophrys, 8-14
gyrola, 8-14
icterocephala, 8-14
inornata, 8-14
nigro-cincta, 8-14
Calothorax lucifer, 202
Calypte anna, 49, 119, 198-201, 122
costae, 198-201, 236
Campylorhynchus brunneicapillus couesi, 240
Canvasback, 51, 136, 231
Capella gallinago, 138, 192
gallinago delicata, 234
Caprimulgus carolinensis, 153
ridgwayi, 261
Caracara, 50
Cardinal, 40, 261
Cardiff, Eugene E., a record specimen of the indigo bunting in California, 100
Cardiff, Eugene E., and Cardiff, Bruce E., an unusual occurrence of the saw-whet owl, 154
Carpodacus cassinii, 206, 244
mexicanus, 40, 53, 120, 146
mexicanus clementis, 120-121
mexicanus frontalis, 120-122, 244
mexicanus solitudinus, 244
purpureus, 145
Carson, James A., burrowing owl with Jerusalem cricket (a photograph), 46
Casmerodius albus, 134
albus egretta, 229
Cassidix mexicanus, 153
Catbird, 154, 240
Cathartes aura, 51, 136
aura teter, 231
Catherpes mexicanus, 53
mexicanus conspersus, 240
Catoptrophorus semipalmatus, 44, 191
semipalmatus inornatus, 234
Centrocercus urophasianus, 233, 260
Centropus milo, 83, 91
milo albidiventris, 82, 87
Centurus uropygialis albescens, 237
Certhia familaris, 142, 206, 240

familiaris leucosticta, 240
familiaris montana, 240
familiaris zelotes, 240
Chaetoptila angustipluma, 41
Chaetura vauxi, 140
vauxi vauxi, 236
Chalcophaps stephani mortoni, 86
Chamaea fasciata, 142
Charadrius alexandrinus, 157, 190
alexandrinus nivosus, 233
hiaticula, 138, 157, 190
hiaticula semipalmatus, 233
nivosus, 43
semipalmatus, 43
vociferus, 122, 138, 156, 190, 262
vociferus vociferus, 233
Chasiempis, 41
sandwichensis sclateri, 34
Chat, 145, 243, 304
Chen hyperborea, 135
hyperborea hyperborea, 230
Chickadee, Black-capped, 142, 239
Chestnut-backed, 142
Mountain, 239
Chicken, Hawaiian, 34, 37
Prairie, 34, 37
Chlidonias niger, 139
niger surinamensis, 235
Chloroceryle amazona, 6-14
americana, 6-14
Chlorodrepanis virens, 35
Chlorospingus, 5
ophthalmicus, 8-14
pileatus, 8-14
Chlorura chlorura, 245
Chondestes grammacus, 51, 146
grammacus strigatus, 245
Chordeiles acutipennis, 302
acutipennis texensis, 19-22, 236
minor, 52, 140, 301-303
minor chapmani, 303
minor hesperis, 236
Chrysolophus pictus, 137
Chuck-will's-widow, 153
Cicada Bird, 89
Cinclus mexicanus, 142
mexicanus unicolor, 240
Circus cyaneus, 136
cyaneus hudsonius, 232
Coccyzus americanus, 18, 139, 207
americanus occidentalis, 235
minor, 18
Cockatoo, 299
White, 87
Cogswell, H. L., review of "Menaboni's Birds," by Athos and Sara Menaboni, 103
Cohen, Nathan W., California condors in Madera County, California, 158
Colaptes auratus borealis, 205, 237
cafer, 52, 140, 181
cafer collaris, 122, 237
Colinus hibbardi, 23-30, 203
virginianus, 23-30, 137, 204
Colius, 82
Collias, Nicholas E., and Taber, Richard D., a field study of some grouping and dominance relations in ring-necked pheasants, 265
Collocalia esculenta becki, 88
vanikorensis, 83
vanikorensis vanikorensis, 88
Columba fasciata, 52, 139, 156, 180
fasciata monilis, 235
nigrirostris, 6-14
speciosa, 6-14
subvinacea, 12
Columbigallina minuta, 6-14
passerina, 6-14
talpacoti, 6-14
Colymbus auritus, 229
caspicus, 134
caspicus californicus, 229
grisegena holböllii, 228
Compsothlypis americana, 100
Condor, Andean, 103
California, 103, 158, 178-179, 231
South American, 102
Contopus richardsonii, 52, 141
virens richardsonii, 238
Coot, American, 138, 233, 262
Hawaiian, 38
Coracina lineata ombriosa, 82, 89
papuensis elegans, 82, 89
Coragyps atratus, 84
Cormorant, Double-crested, 134, 156, 229, 296
Corvus brachyrhynchos, 142
brachyrhynchos hesperis, 239
corax, 142
corax principalis, 101
corax sinuatus, 101, 122, 239
hawaiiensis, 41
Coturnicops noveboracensis noveboracensis, 233
Coturnix, 34, 37
Coucal, Buff-headed, 87, 91
Cowbird, Brown-headed, 145
Common, 101, 244
Red-eyed, 263
Cowles, Raymond B., and Dawson, William R., a cooling mechanism of the Texas nighthawk, 19
Crane, Brown, 137
Sandhill, 233
Creeper, 35
Brown, 142, 206, 240
Crow, 239
American, 142
Crocethia alba, 38, 44, 193, 234
Crossbill, Red, 146, 244, 261
Sitka, 261
White-winged, 157
Crotophaga ani, 10
sulcirostris, 10, 16

Cryptornis antiquus, 153
Cuckoo, Brush, 87
Mangrove, 18
Squirrel, 18
Yellow-billed, 18, 139, 207, 235
Cuckoo-shrike, White-bellied, 89
Yellow-eyed, 89
Cuculus, 154
canorus, 154
canorus bakeri, 155
fugax hyperythrus, 299
optatus, 154
saturatus, 154
saturatus horsfieldi, 154
Curlew, Bristle-thighed, 38
Holarctic, 138
Hudsonian, 138, 189, 191
Long-billed, 98, 138, 190, 191, 234
Cyanocitta cristata, 260
stelleri, 142, 181-182, 239
stelleri frontalis, 239
stelleri macrolopha, 239
stelleri percontatrix, 239
Cyanocompsa parellina, 18
Cyanocorax cucullata, 300
Cyanolyca cucullata, 97, 300
cucullata cucullata, 300
cucullata guatemalae, 300
cucullata hondurensis, 300
cucullata mitrata, 300
mitrata, 97, 302
mitrata cucullata, 98
mitrata guatemalae, 97-98
mitrata hondurensis, 97
mitrata mitrata, 97
pulchra, 97
viridi-cyana, 97
Cyclarhis gujanensis, 17
Cygnus buccinator, 230
columbianus, 135, 229
Cyrtonyx, 24, 203
cooki, 203
montezumae, 51

D

Dactylortyx, 24
Dalquest, Walter W., frigate bird crossing Isthmus of Tehuantepec, 256
Davis, I. Irby, fishing efficiency of the black skimmer, 259
Davis, John, notes on the nomenclature of the brown jay, 152
Davis, John, and Howell, Thomas R., a record of Sphyrapicus varius varius for California, 102
Davis, W. B., and Petrides, George A., notes on the birds of Brazos County, Texas, 153
Dawson, William R., and Cowles, Raymond B., a cooling mechanism of the Texas nighthawk, 19
Deignan, H. G., the genus Cuculus in North America, a reconsideration, 154
Dendragapus fuliginosus, 232
fuliginosus howardi, 232
fuliginosus sierrae, 232
obscurus, 137, 232
obscurus obscurus, 232
obscurus pallidus, 232
Dendrocopos albolarvatus albolarvatus, 237
pubescens, 141, 237
pubescens leucurus, 237
pubescens turati, 237
scalaris, 18
scalaris cactophilus, 237
villosus, 141, 237
villosus leucothorectis, 237
villosus orius, 237
villosus monticola, 237
Dendrocygna bicolor, 55, 158
bicolor helva, 230
Dendroica aestiva, 51, 242
aestiva brewsteri, 242
aestiva morcomi, 242
aestiva rubiginosa, 242
aestiva sonorana, 242
auduboni, 53, 144
auduboni auduboni, 243
coronata, 144, 243
graciae, 156, 260
magnolia, 242
nigrescens, 144, 156, 243
occidentalis, 144, 156, 179, 243
petechia, 144, 242
townsendi, 144, 243
Diomedea albatrus, 35
immutabilis, 35, 40, 41
nigripes, 35, 41
Dipper, American, 142, 240
Dolichonyx oryzivorus, 243
Dollar Bird, 89
Doricha enicura, 202
Dove, Barred, 39
Cassin, 14
Chinese Spotted, 39, 301
Green-winged Ground, 86
Inca, 153, 155
Lace-neck, 39
Mourning, 52, 139, 235, 258, 260, 262
Red-throated Fruit, 85
Rufous Pheasant, 86
Superb Fruit, 85
White-fronted, 14
White-winged, 235
Dowitcher, 138, 155, 187-188
Long-billed, 192, 234
Short-billed, 44, 189, 192
Dryobates scalaris, 52
Dryocopus pileatus, 140
Duck, 205
Greater Scaup, 231
Harlequin, 231
Hawaiian, 37
Lesser Scaup, 51, 231
Ring-necked, 47, 51, 136, 231

Ruddy, 136, 231
Scaup, 136
Shoveller, 156
Wood, 136, 209-220, 231
Ducula rubricera, 83
rubricera rufigula, 85
pistrinaria, 85
Duff, C. V., mourning doves raise triplets, 258
Dumetella carolinensis, 154, 240
Duvall, Allan J., and Taylor, Walter P., the Lucifer hummingbird in the United States, 202

E

Eagle, Bald, 136, 178, 232
Golden, 136, 178-179, 232
Sanford, 84
Ectopistes migratorius, 235
Edolisoma tenuirostre saturatius, 82, 89
Egret, Common, 134, 229
Snowy, 50, 229
Egretta sacra, 83
sacra sacra, 83
Elaenia, 5-14
chiriquensis, 6-14
flavogaster, 6-14
obscura, 6-14
Elepaio, 34
Emberiza hyperborea, 257
Emlen, John T., Jr., and Nero, Robert W., an experimental study of territorial behavior in breeding red-winged blackbirds, 105
Empidonax, 91
difficilis, 52, 141, 179
difficilis difficilis, 122, 238
griseus, 179, 238
hammondii, 141, 238
traillii, 141, 238
trailii adastus, 238
traillii brewsteri, 238
trailii extimus, 238
wrightii, 141, 238
Eos cardinalis, 83, 86
Eremophila alpestris, 141, 153, 238
alpestris ammophila, 238
alpestris insularis, 120, 122
alpestris lamprochroma, 238
alpestris leucansiptila, 238
alpestris utahensis, 238
Ereunetes mauri, 44, 138, 193, 234
Erolia alpina, 138, 193
alpina pacifica, 234
bairdii, 138, 234
melanotos, 138
minutilla, 138, 158, 193, 234
Euphagus cyanocephalus, 102, 145, 243
Euplectes hordeacea, 111
Eupoda montana, 234
Eurystomus orientalis, 83
orientalis solomonensis, 89
Euthlypis lachrymosa, 18

F

Falco albigularis, 103
columbarius, 137, 232, 256
columbarius bendirei, 232
columbarius suckleyi, 232
mexicanus, 137, 232
peregrinus, 54, 137
peregrinus anatum, 122, 343
sparverius, 137
sparverius sparverius, 122, 232
Falcon, Bat, 103
Peregrine, 137, 232
Prairie, 137, 232
Fantail, Cockerell, 90
Rufous-fronted, 90
Finch, Cassin, 206, 244
House, 40, 53, 120-121, 146, 244
Purple, 123, 145
Rosy, 244
Fisher, Harvey I., the avifauna of Niihau Island, Hawaiian Archipelago, 31
Flicker, Red-shafted, 52, 140, 181-182, 237
Yellow-shafted, 205, 237
Florida caerulea, 229
Flycatcher, Ash-throated, 52, 141, 238, 260
Boat-billed, 11
Broad-billed, 91
Derby, 263
Gray, 179, 238
Hammond, 141, 238
Olivaceous, 18
Olive-sided, 52, 141, 238
Traill, 141, 238
Vermilion, 52, 238
Western, 52, 141, 179, 238
Wright, 141, 238
Fregata ariel, 83
magnificens, 256
magnificens rothschildi, 229
minor palmerstoni, 36, 41
French, Norman R., duck hawks nesting in Colorado, 54
Frigate-bird, 36, 229, 256
Fulica americana, 138, 158, 262
americana alai, 38, 41
americana americana, 233

G

Gabrielson, Ira N., and Lincoln, Frederick C., the races of song sparrows in Alaska, 250; post-mortem color change in bird specimens, 298
Gadwall, 51, 135, 230
Gallinula chloropus cachinnans, 233
chloropus sandvicensis, 41
Gallinule, Common, 233
Gallus gallus, 34, 37
Gavia arctica pacifica, 157, 228
immer, 134, 228
stellata, 134
Geococcyx californianus, 52, 101, 235

Geoffroyus heteroclitus heteroclitus, 87
Geopelia striata striata, 39
Geothlypis trichas, 145, 243
trichas occidentalis, 243
trichas scirpicola, 243
Glaucidium brasilianum, 18
gnoma, 139
Gnatcatcher, Black-tailed, 241
Blue-gray, 123, 143, 241
Godwit, Marbled, 44, 187-191, 234
Golden-eye, Common, 136, 231
Goldfinch, Arkansas, 146
American, 146, 156, 244
Lesser, 244
Goodge, William, variation in skeletal measurements of the common murre, 99
Goose, Canada, 135, 230
Emperor, 135
Snow, 135, 230
White-cheeked, 135
White-fronted, 47, 135, 155, 230
Goshawk, 136, 231
Grackle, Boat-tailed, 153
Bronzed, 243
Grater, Russell K., recent bird records from Mount Rainier National Park, 156
Grayson, Andrew Jackson, painting of fulvous tree-duck, opposite 3; bat falcon, opposite 57; ivory-billed woodhewer, opposite 105; derby flycatcher, opposite 209; yellow-breasted chat, opposite 265
Grebe, Eared, 134, 229
Horned, 229
Pied-billed, 51, 134, 229
Red-necked, 228
Western, 134, 229
Grosbeak, Black-headed, 53, 93-96, 145, 244
Blue, 53, 244, 257
Crimson-collared, 18
Evening, 145, 244
Rose-breasted, 154, 244
Grouse, Blue, 137
Dusky, 232
Ruffed, 137
Sharp-tailed, 232
Sooty, 232
Grus canadensis, 137, 233
canadensis canadensis, 233
canadensis tabida, 233
Guinea Fowl, 137
Guiraca caerulea, 53, 244, 257
caerulea interfusa, 244
caerulea salicarius, 244
Gull, Bonaparte, 139, 235
California, 57-77, 139, 158, 235
Franklin, 235
Glaucous, 139
Glaucous-winged, 57-77, 139
Heermann, 221-226
Herring, 59-60, 235
Laughing, 101
Ring-billed, 59, 70, 139, 156, 235
Western, 57-77, 139, 235
Gullion, Gordon W., birds of the southern Willamette Valley, Oregon, 129; the fulvous tree-duck in northeastern California, 158
Gygis alba rothschildi, 41
Gymnogyps californianus, 158, 178-179, 231
Gymnorhinus cyanocephalus, 101, 239, 260

H

Habia gutturalis, 16-17
Haematopus bachmani, 54
Halcyon chloris alberti, 88
saurophaga, 83
saurophaga saurophaga, 89
Haliaeetus leucocephalus, 136, 178
leucocephalus leucocephalus, 122, 232
leucogaster, 84
sanfordi, 84
Haliastur indus girrenera, 83
Haller, Karl W., observations on some New Mexican birds, 155
Harrison, Ed, and Roberts, Frances, photograph of life in a murre colony, opposite 161; photograph of American avocet on nest, 256; photograph of brown booby, 298
Hawk, American Rough-legged, 156, 257
Cooper, 136, 184, 232
Duck, 54
Ferruginous, 232
Ferruginous Rough-legged, 257
Harris, 232
Marsh, 136, 232
Mexican Black, 155
Pied, 84
Pigeon, 232, 256
Red-shouldered, 155
Red-tailed, 51, 136, 151, 178, 232
Rough-legged, 232
Rufous-breasted, 83
Sharp-shinned, 136, 232
Sparrow, 137, 232
Swainson, 136, 178, 232
Hemiprocne mystacea woodfordiana, 88
Hen, domestic, 112
Heron, Black-crowned Night, 37, 229
Great Blue, 134, 229, 260
Green, 134, 229
Little Blue, 229
Mangrove, 83
Reef, 83
Tricolored, 229
Yellow-crowned Night, 153
Hesperiphona vespertina, 145
vespertina brooksi, 244
Heteroscelus incanus, 38, 85
Hickey, Joseph J., mortality records as indices of migration in the mallard, 284
Himantopus himantopus knudseni, 38, 41
mexicanus, 235
Himatione sanguinea, 34

Hirundo rustica, 241, 154
rustica erythrogaster, 122, 239
tahitica, 83
tahitica subfusca, 89
Histrionicus histrionicus pacificus, 231
Honey-eater, Central Solomons, 92
Howard, Hildegarde, Pleistocene duck from Ohio, 205
Howell, Thomas R., Lapland longspur in Arizona, 262
Howell, Thomas R., and Davis, John, a record of Sphyrapicus varius varius for California, 102
Hubbs, Carl L., and Bartholomew, George A., Jr., persistence of a rare color aberration in the Heermann gull, 221
Hummingbird, Allen, 117, 120, 198-201
Anna, 49, 119-120, 198-201
Black-chinned, 52, 198-201, 236
Broad-tailed, 237
Calliope, 237
Costa, 198-201, 236
Lucifer, 202
Rufous, 52, 140, 237
White-eared, 12
Hyde, A. Sidney, white-faced glossy ibis and long-billed curlew in western Colorado, 98
Hydranassa tricolor ruficollis, 229
Hydroprogne caspia, 139, 158, 235
Hylocharis leucotis, 12
Hylocichla fuscescens salicicola, 241
guttata, 143, 182, 179, 241
guttata auduboni, 241
guttata nanus, 241
guttata polionota, 241
guttata sequoiensis, 241
ustulata, 143, 179, 241
ustulata almae, 241
ustulata swainsoni, 241

I

Ibis, White-faced Glossy, 50, 98, 155, 229
Wood, 154, 229
Icteria virens, 145, 304
virens auricollis, 243
Icterus bullockii, 145
bullockii bullockii, 243
cucullatus californicus, 243
parisorum, 53, 243
spurius, 260
Iiwi, 34
Iridoprocne bicolor, 141, 238
Ixobrychus exilis hesperis, 229
Ixoreus naevius, 143
naevius meruloides, 240

J

Jaeger, Edmund C., pebble-dropping by house sparrows, 207
Jay, Blue, 260
Brown, 18, 152
Canada, 142
Green, 18, 124-128
Hooded, 97-98, 300
Piñon, 101, 239, 260
Scrub, 52, 119, 142, 179-182, 239, 260
Steller, 142, 181-182, 239
Jewett, Stanley G., a summer record of the great gray owl in Oregon, 203; an ancient murrelet goes inland, 301; a fatal meal for a young robin, 303
Jollie, Malcolm, a new bird for Idaho, 300
Junco, 53, 206
caniceps, 53
caniceps caniceps, 246
hyemalis, 146, 245
hyemalis cismontanus, 245
hyemalis hyemalis, 245
oreganus, 53, 146, 180, 245
oreganus mearnsi, 245
oreganus montanus, 246
oreganus mutabilis, 246
oreganus shufeldti, 246
oreganus thurberi, 246
Junco, Gray-headed, 53, 246
Oregon, 53, 146, 180, 182, 245
Slate-colored, 146, 245

K

Killdeer, 122, 138, 156, 189, 190, 233
Killpack, Merlin L., lark bunting in Uintah Basin, Utah, 99; short-eared owl eaten by horned owl, 263
Kingbird, Cassin, 52, 238
Eastern, 237
Tropical, 52
Western, 141, 154, 238
Kinglet, Golden-crowned, 143, 206, 241
Ruby-crowned, 53, 123, 143, 206, 241
Kingfisher, Beach, 89
Belted, 140, 153, 237
River, 88
White-collared, 88
Kiskadee, 11
Kite, Chestnut-white, 83
Knight, Howard, and Woodbury, Angus M., results of the Pacific gull color-banding project, 57
Knot, 158 190, 192
Red, 234

L

Lanius excubitor, 144
excubitor invictus, 242
ludovicianus, 51, 122, 242
ludovicianus anthonyi, 120, 122
ludovicianus gambeli, 242
ludovicianus nevadensis, 242
ludovicianus sonoriensis, 242
Larius roratus, 83
roratus pectoralis, 299
roratus solomonensis, 87

Lark, Horned, 120, 141, 153, 238
Larus argentatus smithsonianus, 235
atricilla, 101
californicus, 55-77, 139, 158, 235
delawarensis, 70, 139, 156, 235
fuliginosus, 226
glaucescens, 57-77, 139
heermanni, 221-226
hyperboreus, 139
occidentalis, 139, 235
occidentalis occidentalis, 57-77
occidentalis wymani, 55-77
philadelphia, 139, 235
pipixcan, 235
Leopold, Frederic, a study of nesting wood ducks in Iowa, 209
Lepidocolaptes affinis, 11
souleyetii, 11
Leptotila cassinii, 6-14
cassinii rufinucha, 5
verreauxi, 6-14
verreauxi verreauxi, 5
Leucophoyx thula, 50
thula brewsteri, 229
Leucosticte tephrocotis, 244
tephrocotis littoralis, 244
tephrocotis tephrocotis, 244
tephrocotis wallowa, 244
Limnodromus griseus, 44, 138, 198
griseus scolopaceus, 155
scolopaceus, 192, 234
Limnothlypis swainsoni, 154
Limosa fedoa, 44, 191, 234
Lincoln, Frederick C., and Gabrielson, Ira N., the races of song sparrows in Alaska, 250; post-mortem color change in bird specimens, 298
Linsdale, Jean M., a list of the birds of Nevada, 228
Lint, Kenton C., condor egg hatched in incubator, 102
Lobipes lobatus, 138, 193, 235
Locustella certhiola, 206
ochotensis ochotensis, 206
ochotensis pleskei, 206
Lonchura ferruginosa formosana, 299
ferruginosa rubronigra, 299
punctulata cabanisi, 300
Longspur, Lapland, 247, 262
Loon, Arctic, 157, 228
Common, 134, 228
Red-throated, 134
Lophodytes cucullatus, 136, 231
Lophortyx, 24
californica, 37, 123, 137, 156, 204
californica californica, 233
californica catalinensis, 123
gambelii, 204
gambelii gambelii, 233
Lory, Cardinal, 86
Coconut, 86
Lovell, Harvey B., blue grosbeak in the badlands of South Dakota, 257
Loxia curvirostra, 146, 244
curvirostra bendirei, 244
curvirostra benti, 245
curvirostra grinnelli, 245
curvirostra minor, 261
curvirostra sitkensis, 261
curvirostra stricklandi, 245
leucoptera, 157
Loxops caeruleirostris, 35

M

Macropygia mackinlayi arossi, 86
Magpie, Black-billed, 142, 180, 239, 262
Yellow-billed, 180
Mallard, 135, 230, 284-297
Man-o'-war, Least, 83
Mareca americana, 135, 157, 231
penelope, 135, 230
Marshall, David B., new bird records for western Nevada, 157
Martin, Purple, 142, 239
Matteson, Clyde P., a caracara in Colorado, 50
Mayer, William V., longevity of a crippled Brewer blackbird, 102
Meadowlark, Eastern, 260
Western, 39, 145, 156, 183, 243
Megaceryle alcyon, 140, 153
alcyon caurina, 237
Megarynchus, 18
pitangua, 11
Megapode, 84
Megapodius freycinet, 83
freycinet eremita, 84
Melanitta deglandi, 231
Meleagris gallopavo, 38, 137, 153
Melospiza lincolnii, 147
melodia, 118, 122, 147, 250-255
melodia amaka, 253
melodia caurina, 253-255, 299
melodia cinerea, 257
melodia clementae, 118, 120, 122
melodia cooperi, 119
melodia hyperborea, 257
melodia inexpectata, 255
melodia insignis, 252-254, 257
melodia kenaiensis, 253
melodia maxima, 251-253
melodia morphna, 255
melodia rufina, 254, 299
melodia sanaka, 251-253, 257
melodia semidiensis, 252
Merganser, American, 156
Common, 136, 231
Hooded, 136, 231
Red-breasted, 231
Mergus merganser, 136, 156
merganser americanus, 231
serrator serrator, 231
Merlin, 137

Michener, Josephine R., territorial behavior and age composition in a population of mocking birds at a feeding station, 276
Michener, Josephine R., and Michener, Harold, notes on banding records and plumages of the black-headed grosbeak, 93
Micropalama himantopus, 234
Micropsitta finschii tristrami, 86
meeki, 86
pusio, 86
Miller, Alden H., a comparison of the avifaunas of Santa Cruz and Santa Rosa islands, 117
Miller, Alden H., and Miller, Loye, geographic variation of the screech owls of the deserts of western North America, 161
Miller, Loye, a Miocene petrel from California, 78
Miller, Loye, and Miller, Alden H., geographic variation of the screech owls of the deserts of western North America, 161
Mimus polyglottos, 53, 276-283, 300
polyglottos leucopterus, 122, 240
Mino dumontii kreffti, 92
Miortyx teres, 203
Mniotilta varia, 51, 242
Mockingbird, 53, 240, 276-283, 300
Moho, 41
Molothrus ater, 101, 145, 244, 263
ater artemisiae, 244
ater obscurus, 244
Momotus momota coeruliceps, 18
Monarch, Chestnut-bellied, 90
Pied, 90
Monarcha barbata, 83
barbata browni, 82, 90-92
castaneiventris, 83, 92
castaneiventris richardsii, 90-92
cinerascens, 90
Moore, Robert T., records of two North American corvids in Mexico, 101
Motmot, Blue-crowned, 18
Munia punctulata, 40
Munia, Chestnut-bellied, 299
Murre, Common, 99
Murrelet, Ancient, 123, 301
Myadestes townsendi, 143
townsendi townsendi, 241
Mycteria americana, 154, 229
Myiagra ferrocyanea, 83, 90
ferrocyanea centralis, 91-92
Myiarchus cinerascens, 52, 141, 260
cinerascens cinerascens, 238
tuberculifer lawrenceii, 18
Myiobius atricaudus, 6-14
sulphureipygius, 6-14
Myioborus miniatus, 8-14
torquatus, 8-14
Myiodynastes, 5, 18
chrysocephalus, 7-14
luteiventris, 7-14
Myiozetetes cayanensis, 7-14
similis, 7-14
similis columbianus, 11
similis texensis, 11
granadensis, 7-14
Mynah, 34, 39
Papuan, 92
Myrmotherula axillaris, 6-14
fulviventris, 6-14
Myzomela eichhorni, 83
eichhorni eichhorni, 92

N

Nannorchilus leucogaster, 18
Nectarinia jugularis, 83
jugularis flavigaster, 92
Nephoecetes niger, 140
niger borealis, 236
Nero, Robert W., and Emlen, John T., Jr., an experimental study of territorial behavior in breeding red-winged blackbirds, 105
Nesochen sandvicensis, 41
Nesoclopeus woodfordi, 84
Nighthawk, 52, 301
Booming, 140
Common, 236, 302, 303
Lesser, 236, 302
Texas, 19-22
Noddy, 39
Nucifraga columbiana, 204, 239
Numenius americanus, 98, 138, 191, 234
phaeopus, 138, 191
tahitiensis, 38
Numida meleagris, 137
Nutcracker, Clark, 204, 239
Nuthatch, Pygmy, 150, 206, 240
Red-breasted, 142, 240
White-breasted, 53, 142, 206, 239
Nuttallornis borealis, 52, 141, 238
Nyctanassa violacea, 153
Nyctea scandiaca, 139, 236
Nycticorax nycticorax hoactli, 37, 41, 229

O

Oceanodroma castro cryptoleucura, 36, 41
homochroa, 78-79
hornbyi, 79
hubbsi, 78-80
leucorhoa, 79
macrodactyla, 79
markhami tristrami, 41
melania, 78-79
Oporornis formosus, 154
tolmiei, 145, 243
tolmiei monticola, 243
Oreortyx, 24, 204
picta, 137, 184, 233
picta eremophila, 233
picta picta, 233
Oreoscoptes montanus, 240
Oriole, Bullock, 145, 243

Hooded, 243
Orchard, 260
Scott, 53, 243
Osprey, 84, 137, 232
Otus asio, 139, 161-177, 236
asio aikeni, 168-176
asio cardonensis, 161, 168-176
asio cineraceus, 161, 168-176, 236
asio clazus, 173-174
asio gilmani, 161, 169-176
asio inyoensis, 161, 164, 167-176, 236
asio macfarlanei, 173, 236
asio mccallii, 167-176
asio mychophilus, 169-170
asio quercinus, 161, 168-176
asio sinaloensis, 161, 167-176
asio suttoni, 161, 167-176
asio vinaceus, 168-176
asio xantusi, 161, 164, 167-176
asio yumanensis, 168-176, 236
flammeolus flammeolus, 236
Oven-bird, 153, 243
Owl, Barn, 88, 139, 235
Burrowing, 46, 122, 139, 236
Flammulated, 236
Great Gray, 140, 203
Horned, 139, 236, 262
Long-eared, 140, 236
Pygmy, 18, 19
Saw-whet, 122, 140, 154, 236
Screech, 139, 161-177, 236
Short-eared, 39, 140, 236, 262
Snowy, 139, 236
Spotted, 140
Oxyura jamaicensis, 136
jamaicensis rubida, 231
Oyster-catcher, Black, 54

P

Pandion haliaetus, 137
haliaetus carolinensis, 232
haliaetus melvillensis, 84
Parabuteo unicinctus harrisi, 232
Paroreomyza bairdii, 35
Parrot, King, 87
New Guinea Eclectus, 299
Pigmy, 86
Song, 87
Partridge, Australian Bush, 37
Bush, 34
Chukar, 51, 233
European, 137
Parula pitiayumi, 18
Parus atricapillus, 142
atricapillus nevadensis, 239
atricristatus, 52
gambeli, 239
gambeli abbreviatus, 239
gambeli inyoensis, 239
inornatus, 239
inornatus ridgwayi, 239
inornatus zaleptus, 239
rufescens, 142
Passer domesticus, 92, 145, 207, 243
Passerculus sandwichensis, 146, 245
sandwichensis alaudinus, 245
sandwichensis nevadensis, 245
Passerella georgiana ericrypta, 246
iliaca, 147, 179, 182, 246
iliaca annectens, 298-299
iliaca canescens, 246
iliaca fuliginosa, 298-299
iliaca fulva, 246
iliaca insularis, 298-299
iliaca megarhynchus, 246
iliaca monoensis, 246
iliaca olivacea, 246
iliaca schistacea, 246
iliaca sinuosa, 298-299
iliaca townsendi, 298
iliaca unalascensis, 298-299
lincolnii, 246
lincolni alticola, 246
lincolnii lincolnii, 246
melodia, 246
melodia fallax, 246
melodia fisherella, 247
melodia merrilli, 247
melodia montana, 246-247
melodia saltonis, 247
Passerina amoena, 145, 179, 244
cyanea, 100, 244
Pavo cristatus, 38
Peafowl, 38
Pedioecetes phasianellus columbianus, 232
Pelecanus erythrorhynchos, 134, 229, 296
occidentalis californicus, 229
Pelican, Brown, 229
White, 134, 229, 296
Pennula millsi, 41
Perdix, 24
perdix, 137
Petrel, 78-80
Bonin Island, 36
Bulwer, 36
Hawaiian Storm, 36
Perisoreus canadensis, 142
canadensis griseus, 142
canadensis obscurus, 142
Petrides, George A., and Davis, W. B., notes on the birds of Brazos County, Texas, 153
Petrochelidon pyrrhonota, 142, 239
pyrrhonota albifrons, 239
pyrrhonota hypopolia, 239
Pewee, Wood, 141, 238
Western Wood, 52
Phaeornis, 41
obscura myadestina, 34
Phaethon lepturus dorotheae, 36, 41
rubricauda rothschildi, 36, 41

Phaethornis, 4
longuemareus, 6-14
superciliosus, 6-14
Phainopepla nitens lepida, 241
Phainopepla, 241
Phalacrocorax auritus, 134, 156, 296
auritus albociliatus, 229
Phalaenoptilus nuttallii, 52
nuttallii nuttallii, 236
Phalarope, Northern, 138, 190, 193, 235
Red, 190, 193
Wilson, 138, 156, 235
Phalaropus fulicarius, 193
Pharomacrus mocinno, 4
Phasianus colchicus, 37, 137, 233, 262, 265-275
Pheasant, Golden, 137
Ring-necked, 33, 37, 137, 233, 262, 265-275
Pheucticus ludovicianus, 154, 244
melanocephalus, 53, 93-96, 145
melanocephalus melanocephalus, 244
Philacte canagica, 135
Phillips, Allan R., some observations of birds in southern Colorado, 50
Phillips, Allan R., and Pulich, Warren M., autumn bird notes from the Charleston Mountains, Nevada, 205
Phoebe, Black, 122, 180, 238
Say, 51, 141, 238
Phyllastrephus, 82
Piaya cayana, 18
Pica nuttallii, 180
ornata, 97, 302
pica, 142, 180
pica hudsonia, 239, 262
Picoides arcticus, 237
tridactylus dorsalis, 237
Pigeon, Band-tailed, 52, 139, 156, 180, 184, 235
Domestic, 262
Passenger, 235
Red-knobbed, 83
Pintail, 51, 135, 230
Pipilo aberti dumeticolus, 245
carmani, 194-197
erythrophthalmus, 195
fuscus, 53, 257
hyperboreus, 257
maculatus, 120, 122, 146, 157, 181, 245, 261
maculatus clementae, 120-121
maculatus curtatus, 245
maculatus megalonyx, 120-121
maculatus montanus, 245
socorroensis, 194-197
Pipit, American, 300
Sprague, 300
Water, 51, 143, 241
Pipra coronata, 5, 7-14
mentalis, 5, 7-14
Piranga flava, 53
ludoviciana, 145, 244
rubra cooperi, 244
Pitangus sulphuratus, 11
Pitelka, Frank A., Central American races of Cyanolyca mitrata, 97; breeding seasons of hummingbirds near Santa Barbara, California, 198; the tyrannid Aechmolophus mexicanus in Guerrero, 300; nomenclature of the hooded jay, 300
Platypsaris aglaiae, 18
Plegadis guarauna, 98, 155
mexicana, 50, 229
Plover, Black-bellied, 138, 157, 187, 189-190, 234
Golden, 38, 85, 190
Mountain, 234
Ringed, 138
Semipalmated, 43, 138, 157, 189, 190, 233
Snowy, 43, 157, 190, 233
Pluvialis dominica, 190
dominica fulva, 38, 85, 190
dominica dominica, 190
Podilymbus podiceps, 51, 134
podiceps podiceps, 229
Polioptila caerulea, 143
caerulea amoenissima, 241
melanura lucida, 241
Polyborus cheriway, 50
Pooecetes gramineus, 146
gramineus confinis, 245
Poor-will, 52, 236, 303
Popper, Daniel M., notes on the birds of Mount Locke, Texas, 51
Porter, Richard D., the status of rough-legged hawks in Idaho, 257
Porzana carolina, 138, 202, 233
Porzanula palmeri, 41
Preece, Sherman J., and Selander, Robert K., cock roosts of nighthawks, 302
Procelsterna cerulea saxatilis, 41
Progne subis, 142
subis subis, 239
Prunella montanella, 207
montanella badia, 207
Psaltriparus minimus, 52, 119, 122, 142, 179, 239
minimus plumbeus, 239
minimus providentialis, 239
Psilorhinus morio, 18, 152
moria fuliginosus, 152
morio morio, 152
morio palliatus, 152
Pterodroma leucoptera hypoleuca, 36, 41
phaeopygia sandwichensis, 41
Ptilinopus superbus superbus, 85
viridis, 83
viridis lewisi, 85
Puffinus nativitatus, 36, 41
newelli, 36, 41
pacificus cuneatus, 35, 40, 41
Pulich, Warren M., and Phillips, Allan R., autumn bird notes from the Charleston Mountains, Nevada, 205
Pycnonotus, 83
Pyrocephalus rubinus, 52
rubinus flammeus, 238

Q

Quail, 203
California, 33, 37, 123, 137, 156, 233
Gambel, 233
Mearns, 51
Mountain, 51, 137, 184, 233
Pectoral, 37
Quaintance, Charles W., pioneer starling nesting in eastern Oregon, 50
Quiscalus quiscula versicolor, 243

R

Rail, King, 153
Sora, 202, 233
Virginia, 137, 202, 233
Woodford, 84
Yellow, 233
Rallina euryzonoides euryzonoides, 299
Rallus elegans, 153
limicola, 137, 202
limicola limicola, 233
Raven, 101, 239
Holarctic, 142
Recurvirostra americana, 193, 235
Red-head, 51, 231
Redpoll, Common, 146, 244
Redstart, 54, 154, 243
American, 154
Painted, 205
Red-wing, Tri-colored, 111
Reeder, William G., stomach analysis of a group of shorebirds, 43
Regulus calendula, 53, 143, 206
calendula cineraceus, 241
satrapa, 143, 206
satrapa amoenus, 206
satrapa apache, 206
satrapa olivaceus, 241
Rett, Egmont Z., the painted redstart at Santa Barbara, California, 205
Reuther, Ronald T., the Chinese spotted dove at Bakersfield, 301
Reynolds, Hudson G., red-tailed hawk captures cottontail rabbit, 151
Rhipidura cockerelli, 83
cockerelli albina, 90-92
leucophrys, 83
leucophrys melaleuca, 90
rufifrons, 83
rufifrons granti, 90
Rhodothraupis celaeno, 18
Ricebird, 40
Richmondena cardinalis, 40, 261
Riney, Thane, relationships between birds and deer, 178
Riparia riparia, 141
riparia riparia, 238
Ripley, S. Dillon, migrant and introduced species in the Palau archipelago, 299
Road-runner, 52, 101, 235
Roberts, Frances, and Harrison, Ed, photograph of life in a murre colony, opposite 161; photograph of American avocet on nest, 256; photograph of brown booby, 298
Robin, 181-182, 184, 240, 303
American, 112, 143
Gray, 18
Rynchops nigra, 259

S

Sage Hen, 233, 260
Saltator albicollis, 8-14
atriceps, 18
coerulescens, 8-14
maximus, 8-14
Saltator, Black-headed, 18
Salpinctes obsoletus, 53, 122, 143
obsoletus obsoletus, 240
Sams, James R., and Brattstrom, Bayard H., the Clark nutcracker in San Diego County, California, 204
Sanderling, 38, 44, 189-193, 234
Sandpiper, Baird, 138, 234
Common, 85
Least, 138, 158, 189, 193, 234
Pectoral, 138
Red-backed, 123, 138, 187, 189, 193, 234
Solitary, 138, 234
Spotted, 138, 190-191, 234
Stilt, 234
Western, 44, 138, 187-189, 193, 234
Sapsucker, Williamson, 141, 237
Yellow-bellied, 102, 140, 237
Sayornis nigricans, 180
nigricans semiatra, 122, 238
saya, 51, 141, 238
saya quiescens, 238
saya saya, 238
Scardafella inca, 153, 155
Schwilling, Marvin D., parula warbler nesting in Kansas, 100
Scoter, Surf, 231
White-winged, 231
Seibert, Henri C., least tern in southeastern New Mexico, 204
Seiurus aurocapillus, 153
aurocapillus cinereus, 243
motacilla, 154
noveboracensis, 260
noveboracensis notabilis, 154
Selander, Robert K., and Preece, Sherman J., cock roosts of nighthawks, 302
Selasphorus platycercus platycercus, 237
rufus, 52, 140, 237
sasin, 198-201
sasin sedentarius, 120, 122
Setophaga picta, 205
ruticilla, 54, 154, 243
Shearwater, Christmas Island, 36
Newell, 36
Wedge-tailed, 35

Shoveller, 51, 135, 231
Shrike, Barred Ant, 16-17
Boreal, 144
Loggerhead, 51, 119, 120, 242
Northern, 242
Pepper, 17
Sialia currucoides, 143, 241
mexicana, 53, 143, 180, 241
mexicana bairdi, 241
mexicana occidentalis, 241
Sibley, Charles G., black-and-white warbler in Santa Clara County, California, 51; notes on the birds of New Georgia, central Solomon Islands, 81
Siskin, Pine, 146, 206, 244
Sitta canadensis, 142, 240
carolinensis, 53, 142, 206, 239
carolinensis nelsoni, 239
carolinensis tenuissima, 240
pygmaea, 150, 206, 240
pygmaea canescens, 240
pygmaea melanotis, 240
Skimmer, Black, 259
Skutch, Alexander F., congeneric species of birds nesting together in Central America, 3
Skylark, European, 39
Small, Arnold, laughing gull on the coast of southern California, 101; an unusual concentration of elegant terns in southern California, 154
Snipe, Common, 234
Holarctic, 138
Wilson, 192
Solitaire, Townsend, 143, 241
Sora, 138
Sparrow, Aleutian Song, 251-253
Amak Song, 253
Bell, 119
Bischoff Song, 252-254
Black-chinned, 123, 246
Black-throated, 245
Brewer, 51, 246
Cassin, 245
Chipping, 54, 146, 154, 246
English, 92, 243
Fox, 147, 179, 182, 246, 298-299
Giant Song, 251-253
Golden-crowned, 147, 246
Grasshopper, 153, 245
Harris, 246
House, 145, 207
Kenai Song, 253
Lark, 51, 146, 245
Lincoln, 147
Olive, 18
Riley Song, 255
Rufous-crowned, 53, 118
Sage, 245
Savannah, 146, 245
Song, 114, 118, 120, 147, 246, 250-255, 257
Sooty Song, 254
Swamp, 246
Tree, 146, 246
Vesper, 146, 245
White-crowned, 118, 123, 147, 179, 246
White-throated, 147, 246
Yakutat Song, 253-255
Spatula clypeata, 135, 156, 231
Speotyto cunicularia, 139
cunicularia hypugaea, 122, 236
Sphyrapicus thyroideus, 141, 237
thyroideus nataliae, 237
thyroideus thyroideus, 237
varius, 140, 237
varius daggetti, 237
varius nuchalis, 237
varius varius, 102
Spinus pinus, 146, 206
pinus pinus, 244
psaltria, 146
psaltria hesperophilus, 122, 244
tristis, 146, 156
tristis pallidus, 244
Spizella arborea, 146
arborea ochracea, 146
atrogularis caurina, 123
atrogularis evura, 246
breweri, 51
breweri breweri, 246
passerina, 54, 146, 154
passerina arizonae, 122, 246
Sporophila aurita, 8-14
torqueola, 8-14
Squatarola squatarola, 138, 157, 190, 234
Starling, 50, 242
Brown-winged, 92
Colonial, 92
European, 144
Little, 91
Steganopus tricolor, 138, 156, 235
Stelgidopteryx ruficollis, 141, 156
ruficollis serripennis, 239
Stellula calliope, 237
Sterna, 40
albifrons, 204
anaethetus lunata, 38, 41
antillarum, 235
forsteri, 139, 235
fuscata oahuensis, 39, 41
sumatrana, 85
Stilt, 38
Black-necked, 235
Storer, Robert W., the seasonal occurrence of shorebirds on Bay Farm Island, Alameda County, California, 186
Stott, Ken, Jr., an Anna hummingbird caught in a spider web, 49
Streptopelia chinensis, 39, 301
Stresemann, Erwin, on the supposed identity of Emberiza hyperborea Pallas with Pipilo fuscus Swainson, 257
Strix nebulosa, 140
nebulosa nebulosa, 203
occidentalis, 140

Sturnella magna, 260
neglecta, 39, 122, 145, 156, 183, 243
Sturnus vulgaris, 50, 144
vulgaris vulgaris, 242
Sula dactylatra personata, 36, 41
leucogaster brewsteri, 298
leucogaster plotus, 36, 41, 299
sula rubripes, 36, 40-41
Sunbird, Yellow-bellied, 92
Surf Bird, 123
Sutton, George Miksch, birds and an ant army in southern Tamaulipas, 16; subspecific status of the green jays of northeastern Mexico and southern Texas, 124; Caprimulgus ridgwayi in Michoacan, Mexico, 261
Swallow, Bank, 51, 141, 238
Barn, 141, 154, 239
Cliff, 142, 239
Pacific, 89
Rough-winged, 141, 156, 239
Tree, 51, 141, 238
Violet-green, 52, 141, 238
Swan, Trumpeter, 230
Whistling, 135, 229
Swift, Black, 140, 236
Vaux, 140, 236
Whiskered Tree, 88
White-throated, 236
Swiftlet, Glossy, 88
Vanikoro, 88
Synthliboramphus antiquus, 301

T

Taber, Richard D., and Collias, Nicholas E., a field study of some grouping and dominance relations in ring-necked pheasants, 265
Taber, Wendell, road-runner in Oklahoma, 101
Tachycineta thalassina, 52, 141
thalassina lepida, 238
Tanager, Hepatic, 53
Red-throated Ant, 16-17
Summer, 244
Western, 145, 244
Tanagra, 18
imitans, 8-14
luteicapilla, 8-14
minuta, 8-14
Tangavius aeneus, 263
Tattler, Wandering, 38, 85
Taylor, Lois Chambers, prior description of two Mexican birds by Andrew Jackson Grayson, 194
Taylor, Walter P., and Duvall, Allan J., the Lucifer hummingbird in the United States, 202
Teal, Blue-winged, 51, 123, 135, 157, 230
Cinnamon, 51, 135, 230
Green-winged, 51, 135, 230
Telespiza cantans cantans, 41
cantans ultima, 41
Telmatodytes palustris, 143, 240
palustris aestuarinus, 240
palustris plesius, 240
Tern, 114
Black, 139, 235
Caspian, 139, 154, 158, 235
Elegant, 154
Hawaiian, 39
Forster, 139, 235
Gray-backed, 38
Least, 154, 204, 235
Royal, 154
Sooty, 39
Thalasseus bergii, 85
elegans, 154
Thamnophilus doliatus, 16-17
Thrasher, Bendire, 240
Crissal, 240
Leconte, 240
Long-billed, 18
Sage, 240
Thraupis abbas, 5, 8-14
episcopus, 5, 8-14
palmarum, 5, 8-14
Thrush, Hermit, 143, 179, 182, 241
Kauai, 34
Swainson, 143, 179, 241
Varied, 143, 240
Thryomanes bewickii, 53, 143, 197, 240, 260
bewicki atrestus, 240
bewickii catalinae, 120
bewickii correctus, 120
bewickii eremophilus, 240
bewicki nesophilus, 120, 122
sissonii, 197
Thryothorus maculipectus, 18
modestus, 7-14
nigricapillus, 7-14
nigricapillus semibadius, 14
sissonii, 197
Titmouse, Black-crested, 52
Plain, 239
Tityra inquisitor, 7-14
semifasciata, 7-14
Todirostrum cinereum, 5, 7-14
sylvia, 5, 7-14
Tordoff, Harrison B., osteology of Colinus hibbardi, a Pliocene quail, 23; a quail from the Oligocene of Colorado, 203; Sitka crossbill in Kansas, 261
Totanus flavipes, 138, 158, 234
melanoleucus, 44, 138, 191, 234
Towhee, Abert, 245
Brown, 53, 257
Green-tailed, 245
Socorro, 194-197
Spotted, 120-121, 146, 157, 181, 182, 245, 261
Toxostoma bendirei, 240
dorsale dorsale, 240
lecontei lecontei, 240
longirostre, 18

Tree-duck, Fulvous, 55, 158, 230
Trichoglossus haematodus, 83
haematodus massena, 86
Tringa solitaria, 138
solitaria cinnamomea, 234
Troglodytes aedon, 142
aedon parkmanii, 240
insularis, 194-197
musculus, 5, 7-14
rufociliatus, 5, 7-14
solstitialis, 5, 7-14
troglodytes, 143
troglodytes pacificus, 240
Trogon, 4
elegans ambiguus, 18
Trogon, Coppery-tailed, 18
Tropic Bird, Red-tailed, 36
White-tailed, 36
Turdus assimilis, 7
grayi, 7, 18
ignobilis, 7
migratorius, 143, 181, 303
migratorius propinquus, 240
Turkey, 38
Domestic, 33
Wild, 137, 153
Turnstone, Black, 190, 192
Ruddy, 38, 85, 190-191, 234
Tympanuchus cupido, 37
Tyrannus, 18
melancholicus, 52
tyrannus, 237
verticalis, 141, 154, 238
vociferans, 52
vociferans vociferans, 238
Tyto alba, 139
alba crassirostris, 88
alba pratincola, 122, 235

U

Uria aalge, 99
aalge californica, 99, opposite 161
aalge inornata, 99
Urubitinga anthracina, 155

V

Veery, 241
Verdin, 239
Vermivora celata, 144, 154, 242
celata celata, 242
celata lutescens, 242
celata orestera, 242
celata sordida, 120, 122
chrysoptera, 13
luciae, 155, 242
pinus, 13
ruficapilla, 144, 154, 156
ruficapilla ridgwayi, 242
virginiae, 242
Vestiaria coccinea, 34
Vireo bellii, 242
bellii arizonae, 242
bellii pusillus, 242
flavifrons, 242
gilvus, 144, 242
gilvus leucopolius, 242
gilvus swainsonii, 242
griseus, 18
huttoni, 144
huttoni huttoni, 122
olivaceus flavoviridis, 18
solitarius, 144, 156, 242
solitarius cassinii, 242
solitarius plumbeus, 242
vicinior, 242
Vireo, Bell, 242
Gray, 242
Hutton, 144
Solitary, 144, 156, 242
Warbling, 144, 242
White-eyed, 18
Yellow-green, 18
Vultur gryphus, 102
Vulture, Black, 84
Turkey, 51, 136, 178, 231

W

Wagtail, Willie, 90
Warbler, Audubon, 53, 144, 243
Black-and-white, 51, 242
Black-throated Gray, 144, 156, 243
Blue-winged, 13
Fan-tailed, 18
Golden-winged, 13
Grace, 156, 260
Hermit, 144, 156, 179, 243
Kentucky, 154
Lichtenstein, 18
Lucy, 155, 242
Magnolia, 242
Middendorf's Grasshopper, 206
Myrtle, 144, 243
Nashville, 144, 154, 156, 242
Orange-crowned, 120, 124, 242
Parula, 100
Pileolated, 145, 179, 243
Pitiayumi, 18
Swainson, 154
Tolmie, 145, 243
Townsend, 144, 243
Virginia, 242
Yellow, 51, 144, 242
Water-thrush, Louisiana, 151
Northern, 260
Waxwing, Cedar, 144, 241
Greater, 241
Holarctic, 143
Webster, J. Dan, corrections concerning data on Alaskan birds, 54
Wetmore, Alexander, the original description of the fossil bird Cryptornis antiquus, 153; the identity of two Asiatic birds recorded from Nunivak Island, Alaska, 206

Whip-poor-will, Collared, 261
White-eye, 34, 39
Central Solomons, 92
Widgeon, European, 135, 230
Willet, 187-189, 191, 234
Western, 44
Wilsonia pusilla, 145, 179, 243
pusilla chryseola, 243
pusilla pileolata, 243
pusilla pusilla, 243
Woodbury, Angus M., and Knight, Howard, results of the Pacific gull color-banding project, 57
Woodhewer, Ivory-billed, 159
Woodpecker, Acorn, 140, 180, 237
Black-backed, 237
Downy, 141, 237
Gila, 237
Hairy, 141, 237
Ladder-backed, 18, 52, 237
Lewis, 140, 237
Pileated, 140
Three-toed, 237
White-headed, 237
Wren, Bewick, 53, 120, 143, 197, 240, 260
Cactus, 240
Canyon, 53, 240
House, 142, 240
Long-billed Marsh, 143, 240
Rock, 53, 143, 240
Socorro, 194-197
Spotted-breasted, 18
White-bellied, 18
Winter, 143, 240
Wren-tit, 142

X

Xanthocephalus xanthocephalus, 111, 145, 243
Xanthoura yncas, 18, 124-128
yncas centralis, 128
yncas glaucescens, 124-128
yncas luxuosa, 124-128
yncas maya, 128
yncas vivida, 124-125, 128
Xiphorhynchus flavigaster, 18, 159

Y

Yellow-legs, Greater, 44, 138, 189, 191, 234
Lesser, 138, 158, 234
Yellow-throat, 145, 243
Yocom, Charles F., breeding status of the ring-necked duck in Washington, 47

Z

Zenaida asiatica mearnsi, 235
Zenaidura macroura, 52, 139, 258, 260, 262
macroura marginella, 122, 235
Zonotrichia, 206
albicollis, 147, 246
coronata, 147, 246
leucophrys, 147, 179, 246
leucophrys gambelii, 246
leucophrys nuttalli, 118
leucophrys oriantha, 246
leucophrys pugetensis, 123
querula, 246
Zosterops palpebrosus, 34, 39
rendovae, 83, 90-91
rendovae kulambangrae, 83, 92
rendovae rendovae, 83, 92

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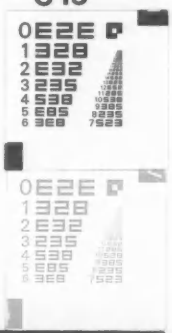
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